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New plants from Wyoming, XV

AVEN NELSON

Eriogonum vegetius (T. & G.)

Perennial, the root woody, ragged, more or less branched at the summit and clothed by the dead leaf-bases: stems scapose, at first white-tomentose, becoming denuded and green, 1–3 dm. high, moderately stout: leaves basal, from nearly oval to spatulate or narrowly lance-oblong, 2–5 cm. long, white-tomentose, tending to become green and glabrate above; the petioles short or sometimes as long as the blade: inflorescence highly characteristic as follows: — a single large sessile (or short-peduncled) involucre at the summit of the scape, from the base of which arise a pair of peduncles (very variable in length), at the summit of which is another involucre and another pair of proliferating peduncles, — such proliferation sometimes occurring a third or even a fourth time with constantly shortening rays: floral bracts large and quite similar to the lower leaves: involucres several- to many-flowered: perianths yellow, more or less silky-villous, on rather long but variable pedicels; the inner segments distinctly longer than the outer, all spatulate or obovate: akene angled by a firm narrow wing-like margin.

This is the *E. Jamesii flavescens* of Watson's Revision (Proc. Am. Acad. **12**: 255) and *E. flavum vegetius* T. & G. Proc. Am. Acad. **8**: 156.

So far as I am aware no one has heretofore taken up the earlier name of this plant, which is most characteristically distinct, though allied to *E. Jamesii* as placed by Watson rather than to *E. flavum*. Since previously very briefly described, a fuller characterization

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may be of service. It occurs from southern Wyoming to New Mexico and specimens of it are not rare. Excellent ones were secured at Sherman, Wyoming, in August, 1901, *no. 8574*.

Eriogonum salinum sp. nov.

Perennial, from a low freely-branched woody base or caudex, with dry shreddy bark: herbaceous stems simple, erect, leafy, 1–2 dm. long, terminating in a short naked peduncle: leaves narrowly lanceolate, rather crowded, mostly erect, subsucculent, white with a fine closely-felted tomentum below (as are also the stems, and inflorescence), short-petioled, glabrous above but very pale, 2–3 cm. long: inflorescence a short broad-topped crowded irregular cyme (not more than 8 cm. high and usually much less), the branching mostly trichotomous but often with some smaller accessory rays; the lower bracts 1 cm. long or less, linear, the others greatly reduced: involucres narrowly turbinate, subsessile, several-flowered, their teeth seemingly obtuse but when divested of their tomentum sharply acute: perianth small, white, its segments obtuse, often apiculate; the outer oblong-elliptic; the inner longer than the outer, obovate: stamens and style-branches included; ovary glabrous.

Allied to *E. microthecum* Nutt., and to *E. effusum* Nutt., but quite distinct from either. The season's branches are simple and permanently leafy. The tomentum is of a different character from that of the allied species and the leaves on the upper surface have in the dried state a somewhat glistening or unctuous appearance. The short inflorescence, forming so small a part of the whole height of the plant, is in sharp contrast to the ample inflorescence of its allies. In this respect it suggests *E. Jonesii* Watson.

This species is an inhabitant of strongly saline soils, as its appearance would suggest. The type was secured on Salt Wells Creek, Sweetwater Co., July 17, 1897, and is *no. 3753*. It was distributed as *E. effusum* Nutt.

Chenopodium aridum nom. nov.

Chenopodium Wolfii Rydb. Bull. Torrey Club, **30**: 248; not *C. Wolfii* Simk. Flora Austro-Hungarica, a species founded upon specimens by G. & J. Wolff, from Transylvania; nor *C. Wolffii* Simk. Termész. Füzetek, **3**: 164. 1879.

Physaria didymocarpa lanata var. nov.

Habit and size of the species; basal leaves more inclined to be irregularly toothed, but the variety mainly distinguished by its copious pubescence as follows: white throughout with long-branched stellate hairs and a more copious simpler pubescence, giving the plant a tomentose appearance especially upon the bases of the crowded crown-leaves and to a lesser degree in the inflorescence: the fruits large, thin and papery.

Collected by L. N. Goodding in the Big Horn Mountains, on steep slopes at the head of the middle fork of Powder river, July 19, 1901, *no. 326*.

Linum compactum sp. nov.

Apparently perennial, from slender rhizomes having somewhat enlarged crowns at the surface of the ground: murky-green, with a scabrous puberulence throughout, seemingly also subglutinous: stems crowded on the crowns, short (about 1 dm. long), each freely short-branched, thus forming plants of subspherical aspect, striate but not all wing-angled: leaves very numerous especially below, divaricate or the lower widely spreading, linear, scarcely exceeding 1 cm. in length, mucronate, the midnerve obscure, the margins slightly cartilaginous-thickened, often with a few minute stipitate glands on the margin near the base; no stipular glands; flowers numerous, on terete or sometimes wing-angled pedicels scarcely longer than the sepals: sepals lanceolate, obscurely 1–3 nerved, short-cuspidate, glandular-ciliate on the scarious margin, 5–6 mm. long, hardly surpassing the mature fruit: petals yellow, wholly glabrous, less than 1 cm. long: filaments linear, not enlarged at base; anthers oval, large, attached near the base: styles free for one third of their length: capsule ovoid, obtuse, about 4 mm. long.

This species is allied to *L. puberulum* (Engelm.) Heller and to *L. Arkansanum* G. E. Osterh. The former differs from this species in its glaucous hue, and in having stipular glands, filaments triangular-ovate at base, and styles united to the summit. The latter differs in having longer leaves, sepals twice as long, and styles united to the summit. Both differ from the species now described in habit, being corymbosely branched from the base up, and in having much larger orange-colored flowers, the petals of which are pubescent at base. The type is *no. 8291*, secured on the North Platte River near the eastern border of Wyoming, Torrington, June 28, 1901, when it was in full fruit almost past blossoming.

Anogra violacea sp. nov.*

Biennial or possibly more enduring, from a vertical, semi-woody taproot: stems several to many, erect with a decumbent base, 2–3 dm. high, violet or purplish throughout (or at least broadly splotched), appearing smooth but puberulent under a lens: crown-leaves rather small, linear-oblanceolate, entire or toothed, few if any of them surviving the first season: stem-leaves puberulent, dark green, numerous, 4–8 cm. long, linear-oblong or narrowly oblanceolate, coarsely sinuate dentate and some of them deeply pinnatifid, the lobes acute, triangular to oblong: flowers axillary, congested at the summit of the stems: buds drooping, oblong or slightly enlarged towards the obtusish tip, pubescent with flat crinkled hairs which are densest at the apex: calyx-lobes a little more than half as long as the tube, tips free: petals triangular-obcordate, sinus broad and shallow, 1–20 mm. long, scarcely longer than the calyx-lobes, white, drying pink: young capsule largest near the base, tapering gradually to a slender apex, subangulate, sinuate-tubercled on the margins, sparsely hispid-ciliate, about as long as the calyx-lobes.

This species probably finds its nearest ally in *A. albicaulis* (Pursh) Britt., from which its numerous, erect, violet stems, its glabrous aspect, its smaller flowers and its divaricate capsule easily separate it.

It occurs in the greatest profusion in sandy draws in south-central Wyoming. Type specimen *no. 3075*, Point of Rocks, June 1, 1897.

Pachylophus glabra sp. nov.

Acaulescent and completely glabrous throughout: perennial (possibly short-lived), from a thick deep-set semi-fleshy root which is caespitosely branched at summit; the enlarged crowns rough with the old dead petioles: leaves crowded on the crowns, nearly linear, 7–12 cm. long, remotely and irregularly toothed on the margins, tapering to both ends, acute at apex, at base passing gradually into the slender petiole which is about half as long as the blade: flowers not equalling the leaves; the calyx-tube slender, only slightly enlarged at the throat, 1 dm. or less long; calyx-lobes about 2 cm. long: petals somewhat inequilateral, broad, deeply cleft-cordate, about 2 cm. long, white, turning pink in fading: the versatile anthers and the filaments subequal, about

* The description of this species was prepared some years since but was withheld from publication. Dr. Rydberg now kindly writes me that he has received it in good fruit. "The fruit is narrowly linear-cylindric, standing out at right angles to the stem and therefore in (sharp) contrast to *A. albicaulis*."

12 mm. long: the stigmas surpassing the petals when the latter are closed: fruits small, 12–15 mm., strictly basal, not tubercled and but slightly angled.

If one accepts the current descriptions of *P. caespitosa* (Nutt.) Raimann as really applying to the *Oenothera caespitosa* of Nuttall, there can then be no doubt about the validity of the species now described. In Nuttall's Genera he uses the word "smooth" of the leaves and "cespitose" of the crowns which is just the case in the now proposed *P. glabra*. But he also speaks of the large size of the flowers and the tuberculate capsule which are characters of the pubescent plant we have so long recognized as Nuttall's. Whatever, then, Nuttall's plant may prove to be, the present one seems distinct and is readily known by its wholly glabrous condition, narrow leaves which surpass the much smaller flower, and the capsule which is not tubercled but which has four rounded veins.

The type specimens were collected on the Platte River bottoms, near Badger, Wyoming (Laramie County), June 1, 1901, *no. 8340*.

Lavauxia flava sp. nov.

Stemless, perennial (probably short-lived) from somewhat fleshy roots, nearly glabrous, only a little pubescence on the margins of the leaves: leaves crowded on the crown, oblong-lanceolate in outline, gradually narrowed to the margined base, deeply and irregularly runcinate-pinnatifid, 15–25 cm. long (including petiole): flowers much shorter than the leaves; calyx-tube 4–7 cm. long, its lobes about 2 cm. long: petals yellow, invariably turning pink with age and in drying, obovate, attached by a broad base, entire and broadly rounded at summit: stamens shorter than the petals, the filaments rather broad, the anthers attached about one third of their length from the base: capsule oblong, narrowly wing-angled, 2–3 cm. long, one third as broad: seeds numerous, cuneate-obovate, slightly concave with a carinate ridge on the ventral side, and with a narrow crest-like margin around the obtuse summit.

At least some of the plants from the Rocky Mountains which have passed as *Lavauxia triloba* (Nutt.) Spach are distinct from that species, whether we consider the Nuttallian plant from the Red river country (Arkansas) or that one in literature which is said to have white flowers. Nuttall's plant was described as having

large membranaceous leaves, somewhat trilobed petals (hence the name), and ovoid capsules with broad reticulated wings. None of these characters apply to *L. flava*. It has a capsule both relatively and actually longer than that of the other, with narrow wings and not very evident reticulation. In the seeds we find further evidence of the distinctness of the two since *L. flava* does not possess the tubercle on the inner upper face nor the broad tooth at the apex.

Dr. Watson seems to be the only one who has called attention to the yellow flowers of this western form, which he has done in two instances, viz., Bot. King's Rep. 107, and Fl. Calif. 1 : 224 ; and in both cases he was, of course, dealing with the western plants.

I do not venture to say that all the plants of the west that have heretofore been called *L. triloba* belong to *L. flava*. That can only be determined by finding whether they have the characters of the latter. Hence I name a type, my *no. 219*, Laramie, June, 1894, and as illustrative of it all of my numbers, distributed from time to time, under the name *Lavauxia* (*Oenothera*) *triloba*.

Gentiana monantha sp. nov.

An alpine annual, mostly much less than 1 dm. high : stem simple or with one or two branchlets from the base, very short, of few internodes, only 1–3 cm. high, terminated by a slender naked one-flowered peduncle very much longer than the stem ; the accessory branchlets (if any) tardily developed and with a shorter peduncle : leaves oblong to spatulate, 5–10 mm. long : calyx one fourth shorter than the corolla and somewhat exceeding its tube ; sepals 4, equal, oblong-lanceolate, subacute, distinct nearly to the base : corolla about 12 mm. long, its tube twice as long as the 4 lance-ovate subacute lobes ; the fimbriae of the crown rather coarse and short : stamens shorter than the corolla-tube.

This is *G. tenella*, in so far as the plant of the southern Rocky Mountains is concerned. Seemingly very rare and probably not well represented in the herbaria. Most of what has been distributed as *G. tenella*, in so far as my own specimens are concerned, belongs to other species (*G. acuta*, *G. heterosepala*, etc.). The true *G. tenella* Rottb. is an arctic plant with 5-merous flowers, the obtuse corolla-lobes as long as its tube ; the calyx only half as long as the corolla and with unequal sepals.

The best example I have seen of *G. monantha* is Dr. Clements' *no. 456*, Mirror Lake (altitude 3500 m.), Colorado, Sept. 6, 1901; I name this as the type.

Chondrophylla gen. nov.

Small biennials (?) from a few cm. to 1 dm. high, the stems single or several from the slender root. Leaves numerous, small, opposite, seemingly imbricated below because of the short internodes, the margins white and scarious or cartilaginous. Flowers solitary and terminal. Calyx narrow, 4- or 5-toothed. Corolla salver-form when expanded, plicate at the sinuses with broad emarginate lobes or plates, without crown or glands. Anthers cordate, versatile. Seeds oblong, with a close coat.

The two species following, which have long stood as a section of *Gentiana*, are so completely out of harmony with the other sections of that genus that it would certainly tend toward simplicity to elevate the section to generic rank. In doing so I have used the sectional name of Bunge and Grisebach. The minute cartilage-margined leaves, the solitary terminal flowers, the versatile anthers are generic characters separating these plants from *Gentiana*.

Chondrophylla Fremontii (Torr.)

Gentiana humilis of Gray, Syn. Fl. **2**[1]: 120; Engelm. Trans. Acad. St. Louis, **2**: 217, *pl. 9*; *G. Fremontii* Torr. in Frém. Rep. 94; probably *G. humilis* Stev. Act. Mosq. **3**: 258. 1812; Griseb. Gent. 251: not *G. humilis* Salisb. Prodr. 137. 1796.

Since the specific name so long in use is not available, I take up Torrey's name.

Chondrophylla Americana (Engelm.)

Gentiana prostrata Americana Engelm. Trans. Acad. St. Louis, **2**: 217, *pl. 9*, 1862; probably not *Gentiana prostrata* Haenke; Jacq. Coll. **2**: 66, nor of later authors.

The Rocky Mountain plant seems to be distinguishable from the arctic and European forms, so Engelmann's name is adopted.

Hedeoma ovata sp. nov.

Perennial, the slender branches of the caudex widely divaricate from the summit of the taproot; stems slender, branched, 12–20 cm. high, puberulent with recurved hairs: leaves entire, oval, from

broadly to narrowly so, 7–15 mm. long, glabrous above, nearly so below, crowded and more bract-like upward: flowers small, cymulose in the axils, short-pedicelled and bracteolate: calyx about 5 mm. long, its lower teeth surpassing the upper, somewhat hispid-pubescent on the tube and teeth: corolla inconspicuous, barely surpassing the longer calyx-teeth, the upper lip 2-lobed; staminodia wanting.

Not closely allied to any of the northern species. The type number, collected by the writer, on Pole Creek, June 30, 1895, was distributed as *H. Reverchoni*, to which it may be most nearly allied.

Castilleja pilifera sp. nov.

Perennial, more or less finely pilose throughout; stems several from the crown of a caudex, slender and erect from a somewhat decumbent base, 15–25 cm. high: leaves numerous, flaccid, nearly linear, entire or with one or more linear divergent lobes, 3–6 cm. long: calyx a little shorter than the bracts, equally cleft above and below to the middle; the lobes linear and rarely more than bidentate at apex: corolla about 2 cm. long (shorter than the calyx), tubular; the lip as long as the galea and about one fourth as long as the tube, its linear teeth as long as the obscurely saccate base.

It is strongly to be suspected that most if not all the plants of the Rocky Mountains that have heretofore been called *C. pilosa* (*Orthocarpus pilosus*) are not that species at all. That species was founded on very limited material, but the original description by Watson, in Bot. King's Rep., 231, calls attention to the calyx, "cleft nearly to the base anteriorly, 4-lobed to the middle and shorter than the corolla." The description in Flora of California may cover this species alone, but that of Gray, Syn. Fl., undoubtedly is more inclusive though too brief to indicate that fact clearly. *C. pilosa* probably belongs in the Sierra Nevada and northwestward.

The type of *C. pilifera* is *no. 5878*, A. & E. Nelson, Soda Butte, Yellowstone Park, July 15, 1899. It was distributed as *C. pilosa*.

Symphoricarpos Tetonensis sp. nov.

Wholly glabrous; branches dark brown, with smooth bark (not shreddy); the young twigs light brown; leaves green, somewhat lighter beneath and subglaucous, narrowly elliptic and taper-

ing somewhat cuneately from the middle to the acute ends, 3–4 cm. long, entire or with a few irregular acute teeth, the veins conspicuous and the margin slightly thickened-revolute; petioles slender, 4–6 mm. long, dilated and somewhat connate at base: flowers in the upper axils, mostly twin, drooping, on short pedicels: calyx minute, less than 2 mm. long, acetabuliform, its lobes about as long as the shallow cup: ovary oblong, 3–4 mm. long, about twice as long as the lanceolate bracts at its base, which in turn are about as long as the pedicels — all of these structures purplish-blue as if with bloom: corolla ochroleucous tinged with pink, gradually dilated-tubular, less than 1 cm. long, its rounded lobes half as long as the tube, nearly glabrous within, only a few inconspicuous hairs near the middle of the tube, glandular from the hairs down: filaments shorter than the anthers; style glabrous, half as long as the corolla; fruit not known.

This is a member of the *S. oreophilus* group, which now contains several species. Among them, however, there is no species so wholly glabrous, nor with leaves like those of the species now proposed. The floral characters, while characteristic, are less noticeable.

The type is *no. 1025*, by Merrill and Wilcox, Teton Mountains, Wyoming, July 26, 1901. Paratypes (probably) in the National and in the New York Botanical Garden herbaria.

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CODE OF BOTANICAL NOMENCLATURE

A Nomenclature Commission was appointed by the Botanical Club of the American Association for the Advancement of Science at a meeting held in Washington, D. C., January 2, 1903. At this meeting a series of rules for nomenclature was presented and referred to the Commission, which has carefully considered all the principles involved, and has tested the application of the principles to all kinds of cases. The Commission has found that, for purposes of more exact statement, and to reach more satisfactory results, some rearrangement and modification of the rules as proposed at this Washington meeting are advisable. The principles have been carefully compared with those advanced in the Laws for Nomenclature adopted at the Paris Botanical Congress in 1867, and at the Botanical Congress held in Genoa in 1892, together with propositions advanced by various groups of botanists, and by individuals, during the past few years, and the methods pursued by zoologists have also been studied; all with the plan of obtaining a code of nomenclature which will best satisfy all interests involved. The action of the International Botanical Congress, held in Paris in 1900, by which the subject of nomenclature is to be brought before the International Congress to be held at Vienna in 1905, has been considered, and the decision there reached to base a new set of rules upon those adopted by the Paris Congress of 1867 has had our careful attention. This action contemplates the modification of the Paris Laws of 1867 by amendment, abandonment, or substitution of its various articles. We have found, however, that the Paris Laws of 1867 are not satisfactorily adaptable to precisely this consideration, for the reasons that their arrangement is not philosophical in the light of modern experience and knowledge, that many important principles are either not recognized, or else given altogether too meager consideration, and that there is a want of definite and exact statement, which leads to ambiguity. We therefore recommend, and propose also to move in the Vienna Congress of 1905, that, in accordance with the provisions of the

committee on organization of the Congress of 1905, the code of laws of 1867 be amended by the abandonment of all its articles and the substitution of the appended code.

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MEMBERS AND ALTERNATES OF THE NOMENCLATURE COMMISSION

CODE OF BOTANICAL NOMENCLATURE

PART I. PRINCIPLES.

1. The primary object of formal nomenclature in systematic biology is to secure stability, uniformity and convenience in the designation of plants and animals.
2. Botanical nomenclature is treated as beginning with the general application of binomial names of plants (Linnaeus' Species Plantarum, 1753).
3. Priority of publication is a fundamental principle of botanical nomenclature. Two groups of the same category cannot bear the same name.

NOTE.—Previous use of a name in zoology does not preclude its use in botany.

4. The application of a name is determined by reference to its nomenclatorial type.

PART II. CANONS.

Section I. Categories of Classification.

CANON 1. Connected or coherent groups of individuals are termed species.

CANON 2. Species are grouped into genera; genera into tribes; tribes into families; families into orders; orders into classes; classes into phyla.

NOTE.—Order is preferable to cohort and phylum to division, conforming to zoological usage.

CANON 3. When additional categories are necessary for the convenient presentation of relationships, they are to be obtained by the recognition of intermediate groups, the names of which are formed by prefixing sub- to the names of the above principal categories.

EXAMPLES.—Subspecies, subgenus, subfamily, suborder.

CANON 4. Other terms, such as group, section, series, division, and branch, may be used for more convenient temporary arrangement under the above categories, but their names are to have no validity in formal taxonomy.

NOTE.—The term variety is relegated to horticultural usage.

Section II. Formation of Names.

CANON 5. Specific and subspecific names consist of Latin or Latinized adjectives or substantives, the latter being either nominatives in apposition or genitives.

EXAMPLES.—*Hookerianus; europaeus; vulgaris; heterophyllus; malvicola; Tulipifera; Tuna; Engelmanni; Sonorae; Trifolii.*

CANON 6. Generic and subgeneric names consist of Latin or Latinized substantives, or equivalent terms.

EXAMPLES.—*Rosa; Convolvulus; Hedysarum; Bartramia; Liquidambar; Couroupita; Tsuga; Gloriosa; Impatiens; Manihot.*

CANON 7. Names for subtribes, orders, and intervening groups, are formed from names of component genera.

(*a*) For names of tribes add -eae, of families -aceae, of orders -ales, to the stem of the generic name.

EXAMPLES.—*Roseae; Rosaceae; Rosales.*

(*b*) For names of subtribes add -anae, of subfamilies -atae, of suborders -ares, to the stem of the generic name.

EXAMPLES.—*Rosanae; Rosatae; Rosares.*

CANON 8. Names for subclasses and higher groups consist of plural Latin or Latinized substantives.

EXAMPLES.—*Monocotyledones; Angiospermae; Pteridophyta.*

Section III. Publication of Names.

CANON 9. A specific or subspecific name is published when it has been printed and distributed with a description (or in palaeobotany a figure), or with a reference to a previously published description.

EXAMPLES.—*Coursetia arborea* Griseb. Fl. Brit. W. Ind. 183 (1859), is published with a description; *Cynanchum nivale* Nym. Syll. Fl. Eur. 108 (1855), is published with a reference to the previously described *Vincetoxicum nivale* Boiss. & Heldr.; *Pterospermites Whitei* Ward, Ann. Rep. U. S. Geol. Surv. **6**: 556. *pl. 56, f. 5, 6* (1885), a fossil species, is published with a figure, but without a description.

(*a*) Names published for primary subdivisions of species are treated as subspecific names, however designated by their authors.

EXAMPLES.—*Juglans alba minima* Marsh. Arb. Am. 68 (1785); *Scirpus maritimus β fluviatilis* Torr. Ann. Lyc. N. Y. **3**: 324 (1836); *Zizia aurea* var. *Bebbii* Coult. & Rose, Bot. Gaz. **12**: 138 (1887); these are primary divisions of species, which are recognizable as subspecies.

(*b*) In the transfer of a species from one genus to another the original specific name is retained, unless the resulting binomial has been previously published.

EXAMPLES.—*Bromus giganteus* L. Sp. Pl. 77, is *Festuca gigantea* (L.) Vill. Hist. Pl. Dauph. **2**: 110 (1787); *Arum triphyllum* L. Sp. Pl. 965, is to be known as *Arisaema triphyllum* (L.) Torr. Fl. N. Y. **2**: 239 (1843), not as *Arisaema atrorubens* Blume, Rumphia, **1**: 97 (1835); *Laurus Sassafras* L. Sp. Pl. 371, is to be known as *Sassafras Sassafras* (L.) Karst. Deutsch. Fl. 505 (1881), not as *Sassafras officinale* Nees & Eberm. Handb. Med.-pharm. Bot. **2**: 418 (1831); however, *Schoenus pusillus* Sw. Nov. Gen. & Sp. Pl. 20 (1788), when transferred to *Rynchospora*, is not to be known as *Rynchospora pusilla* (Sw.) Griseb. Kar. 123 (1857), because prior to 1857 the same binomial had been used for another species, *Rynchospora pusilla* Chapm. (1849).

(*c*) A subspecies elevated to specific rank retains the same name, unless the resulting binomial has been previously published.

EXAMPLES.—*Sparganium simplex androcladum* Engelm. in A. Gray, Man. ed. 5, 481 (1867), if regarded as a distinct species, becomes *Sparganium androcladum* (Engelm.) Morong, Bull. Torrey Club, **15**: 78 (1888); however, *Juncus acuminatus robustus* Engelm. Trans. Acad. Sci. St. Louis, **2**: 463 (1868), does not become *Juncus robustus* (Engelm.) Coville in Britt. & Brown, Ill. Fl. **1**: 395 (1896), because prior to 1896 the binomial had been used for another species, *Juncus robustus* S. Wats. Proc. Am. Acad. **14**: 302 (1879).

CANON 10. A generic or subgeneric name is published when it has been printed and distributed (1) with a generic or specific description (or in palaeobotany a figure) and a binomial specific name, (2) with a generic and specific name and the citation of a previously published description, or (3) with a reference to a specific description, which is associable by citation with a previously published binomial species.

EXAMPLES.—*Pachysandra* Michx. Fl. Bor. Am. **2**: 177 (1803), is published with a generic and specific description and a binomial specific name; *Brasenia* Schreb. ex Gmel. Syst. **2**: 853 (1791), is published with a generic description and a binomial specific name; *Silphium* L. Sp. Pl. 919 (1753), is published with a specific description and a binomial specific name; *Poacites* Schloth. Petrefact. 416. *pl. 26, f. 1, 2* (1820), a fossil genus, is published with figures and a binomial specific name, but without a description; *Nyssa* L. Sp. Pl. 1058 (1753), is published with a generic and specific name and the citation of previously published descriptions; *Dryopteris* Adans. Fam. Pl. **2**: 20 (1763), is published with a reference to a specific description associable by citation with the previously published *Polypodium Filix-mas* L. Sp. Pl. 1090 (1753), inasmuch as both Adanson and Linnaeus cite *Filix mas* of Fuchs.

CANON 11. Names of subtribes, orders, and intervening groups are published when they have been printed and distributed with direct or indirect citations of component genera.

EXAMPLES.—*Moraceae* Lindl. Veg. Kingd. 266 (1847), is published with the citation of component genera; *Ophioglossales* Engler, Syll. ed. 2, 63 (1898), is published with the citation of component genera.

CANON 12. A name is not published by its citation in synonymy, or by incidental mention.

EXAMPLES.—*Echeveria spicata*, cited by De Candolle, Prodr. 3: 349 (1828), as a synonym of *Fouquiera formosa*, is not published, and does not invalidate *Echeveria* DC. published on page 401 of the same volume; *Acrostichum Plumieri* "Desv. herb.," cited as a synonym of *A. viscosum* in Fée, Mém. Fam. Foug. 2: 46 (1845), is not published, and does not invalidate *Acrostichum Plumieri* Fée, published as a species on page 50 of the same work; *Hormisus opuntioides* Targ., cited by Bertoloni, Amoen. Ital. 316 (1819), as a synonym of *Fucus Sertolara* Bertol. (= *Halimeda Tuna*), is not thereby published.

CANON 13. Of names published in the same work and at the same time, those having precedence of position are to be regarded as having priority.

EXAMPLES.—*Alsine* L. Sp. Pl. 272, is to be regarded as having priority over *Stellaria* L. Sp. Pl. 421; *Aira spicata* L. Sp. Pl. 63, is to be regarded as having priority over *Aira spicata* L. Sp. Pl. 64; *Hibiscus Moscheutos* L. Sp. Pl. 693, is to be regarded as having priority over *H. palustris*, which it precedes on the same page.

Section IV. Application of Names.

CANON 14. The nomenclatorial type of a species or subspecies is the specimen to which the describer originally applied the name in publication.

EXAMPLES.—*Polypodium marginale* L. Sp. Pl. 1091, is typified by the designation of a specimen collected in Canada by Kalm; *Stachys arenicola* Britton, Man. 792 (1901), is typified by the designation of a specimen from Staten Island, New York; *Carex intumescens Fernaldii* Bailey, Bull. Torrey Club, 20: 418 (1893), is typified by a specimen collected at Cedar Swamp, Aroostook County, Maine, by M. L. Fernald.

(*a*) When more than one specimen was originally cited, the type or group of specimens in which the type is included may be indicated by the derivation of the name from that of the collector, locality or host.

EXAMPLES.—*Eriogonum Porteri* Small, Bull. Torrey Club, 25: 41 (1898), is based on several specimens, of which the one collected by T. C. Porter is the type; *Gaillardia arizonica* A. Gray, Syn. Fl. N. Am. 1[2]:

353 (1884), is based on several specimens, of which the one collected by Palmer in Arizona is the type; *Cuscuta Cephalanthi* Engelm. Am. Jour. Sci. **43**: 336 (1842), is based on specimens from several hosts, of which the one from *Cephalanthus* is the type.

(*b*) Among specimens equally eligible, the type is that first figured with the original description, or in default of a figure the first mentioned.

EXAMPLES.—*Calyptridium roseum* S. Wats. Bot. King's Exp. 44. *pl. 6, f. 6–8* (1871), is based on at least three specimens, of which the one figured is the type; *Arnica cordifolia* Hook. Fl. Bor. Am. **1**: 331 (1833), is based on two specimens, neither of which is figured, and the one first mentioned, which was collected by Drummond in alpine woods of the Rocky Mountains, is the type.

(*c*) In default of an original specimen, that represented by the identifiable figure or (in default of a figure) description first cited or subsequently published, serves as the type.

EXAMPLES.—*Trillium sessile* L. Sp. Pl. 340, is based on three citations, of which the second is the type, being accompanied by a figure; *Centaurea Scabiosa* L. Sp. Pl. 913, is based on a number of citations, of which the first mentioned is the type, as no figures are cited.

CANON 15. The nomenclatorial type of a genus or subgenus is the species originally named or designated by the author of the name. If no species was designated, the type is the first binomial species in order eligible under the following provisions:

(*a*) The type is to be selected from a subgenus, section or other list of species originally designated as typical.

EXAMPLES.—*Psilogramme* Kuhn, Festschr. 50-Jähr. Jub. Königs. Realschule zu Berlin, 332 (1882), is typified by the first mentioned species of the second section *Eupsilogramme*, and not from species included in the first section *Jamesonia*, which is based on a generic name previously published; *Phania* DC. Prodr. **5**: 114 (1826), is typified by *P. multicaulis* DC., the only species of the section *Euphania*.

(*b*) A figured species is to be selected rather than an unfigured species in the same work; or, in the absence of a figure, preference is to be given to a species accompanied by the citation of a figure.

EXAMPLES.—*Lespedeza* Michx. Fl. Bor. Am. **2**: 70 (1803), is typified by *L. procumbens* Michx. *loc. cit. pl. 39*, the species first figured; *Basanacantha* Hook. f. in Benth. & Hook. Gen. Pl. **2**: 82 (1873), is typified by *Randia tetracantha* (Cav.) DC., the second species cited, as this had been figured by Cavanilles, whereas *Randia Humboldtiana* DC., the species first mentioned by Hooker, had not been figured.

(*c*) The types of genera adopted through citations of nonbinomial literature (with or without change of name), are to be selected from those of the original species which receive names in the first binomial publication. The genera of Linnaeus' Species Plantarum (1753) are to be typified through the citations given in his Genera Plantarum (1754).

NOTE.—The Species Plantarum contains no generic references, but the 1754 edition of the Genera Plantarum was evidently prepared at the same time and was in effect a complementary volume of the same work. It accords much more nearly than other editions with the treatment followed in the Species Plantarum, and thus makes it possible to retain more of the Linnaean generic names in their current application.

EXAMPLES.—*Cypripedium* L. Sp. Pl. 951, a genus adopted from Tournefort with a change of his name *Calceolus*, is typified by *Cypripedium Calceolus*, the only species common to both authors; *Seseli* L. Sp. Pl. 259, a genus adopted from Boerhaave, is typified by the second species of Linnaeus, *Seseli montanum*, which is the first in Linnaeus of the species common to both authors; *Silene* L. Sp. Pl. 416, a genus adopted from Dillenius with a change of his name *Viscago*, is typified by *Silene anglica*, the first in Linnaeus of the thirteen species figured by Dillenius; *Fritillaria* L. Sp. Pl. 303, a genus adopted from Tournefort, is typified by the fifth species of Linnaeus, *Fritillaria Meleagris*, which is one of the three species included in *Fritillaria* by both authors, and is selected from these three because it is the one figured by Tournefort.

(*d*) When a prebinomial generic name is displaced by the publication of a generic name within binomial usage, the application of the displaced name to a species under the new generic name designates the type.

EXAMPLE.—*Dianthus* L. Sp. Pl. 409, a genus adopted from Tournefort with a change of his name *Caryophyllus*, is typified by *Dianthus Caryophyllus*, one of the fifteen original species of Linnaeus.

(*e*) The application to a genus of a former specific name of one of the included species, designates the type.

EXAMPLES.—*Amsonia* Walt. Fl. Car. 98 (1788), is typified by *Tabernaemontana Amsonia* L., one of its two original species; *Sordaria* Ces. & DeN. Comm. Soc. Critt. Ital. 1: 225 (1863), is typified by *Sphaeria Sordaria* Fr., one of its twelve original species.

(*f*) To avoid change in the current application of a Linnaean generic name, a well-known economic species may be selected as the type, in accordance with the principle stated by Linnaeus (Phil. Bot. 197. 1751): "Si genus receptum, secundum jus naturae et artis, in plura dirimi

debet, tum nomen antea commune manebit vulgatissimae et officinali plantae."

EXAMPLES.—*Poa* L. Sp. Pl. 67, is typified by *P. pratensis* L., the commonest of its original species; *Mollugo* L. Sp. Pl. 89, is typified by *M. verticillata* L., the commonest of its original species.

Section V. Rejection of Names.

CANON 16. A name is rejected when preoccupied (homonym).

(*a*) A specific or subspecific name is a homonym when it has been published for another species under the same generic name. Two subspecies of the same genus shall not retain the same name.

EXAMPLES.—*Acer saccharinum* Wang. Amer. 36. *pl. 2, f. 26* (1787), is a homonym of *Acer saccharinum* L. Sp. Pl. 1055 (1753); *Vaccinium myrtilloides* Hook. Fl. Bor. Am. 2: 32 (1834), is a homonym of *Vaccinium myrtilloides* Michx. Fl. Bor. Am. 1: 234 (1803), and is rejected whether the latter species is regarded as distinct or not; *Juncus nodosus megacephalus* Torr. Fl. N. Y. 2: 326 (1843), is a homonym of *Juncus megacephalus* M. A. Curtis, Boston Jour. Nat. Hist. 1: 132 (1835); *Chrysopsis pilosa* (Walt.) Britton, Mem. Torrey Club, 5: 316 (1894), is a homonym of *Chrysopsis pilosa* Nutt. Jour. Acad. Nat. Sci. Phila. 7: 66 (1834), and is to be rejected, notwithstanding the fact that *Erigeron pilosum* Walt. was published in 1788; *Carex scoparia moniliformis* Tuckerm. Enum. Meth. Car. 17 (1843), and *Carex straminea moniliformis* Tuckerm. *loc. cit.*, can not both be maintained.

(*b*) A generic or subgeneric name is a homonym when previously published, or proposed in print, for another genus.

EXAMPLES.—*Torreya* Arn. Ann. Nat. Hist. 1: 130 (1838), is a homonym of *Torreya* Raf. Am. Mo. Mag. 3: 356 (1818), of *Torreya* Raf. Jour. Phys. 89: 105 (1819), of *Torreya* Spreng. Neue Entdeck. 2: 121 (1821), and of *Torreya* Eat. Man. ed. 5, 420 (1829); *Rivularia* Ag. Syn. Alg. Scand. xxxviii (1817), is a homonym of *Rivularia* Roth, Cat. 1: 212 (1797); *Nesaea* Lamour. Nouv. Bull. Soc. Philom. 3: 185 (1812), is a homonym of *Nesaea* Commers. ex Juss. Gen. Pl. 332 (1789); *Bulliarda* DC. Bull. Soc. Philom. 3^{49}: 1 (1801), is a homonym of *Bulliarda* Neck. Elem. 2: 321 (1790).

(*c*) Similar names are to be treated as homonyms only when they are mere variations in the spelling of the same word; or in the case of specific and subspecific names, when they differ only in adjective or genitive termination.

EXAMPLES.—*Penicillus* and *Penicillium*, *Callitriche* and *Calothrix*, *Nemastylis* and *Nematostylis*, *Pterigophyllum* and *Pteridophyllum*, may be maintained; *Cyathophora* and *Cyathophorum*, *Asterocarpus* and *Astrocarpus* can not be maintained. *Greenei* and *Greenii*, named for different

persons, Greene and Green, may be maintained in the same genus; *virginicus*, *virginianus* and *virginiensis*, *oreganus* and *oregonensis*, *Hookeri* and *Hookerianus*, can not be maintained in the same genus.

CANON 17. A name is rejected when there is an older valid name based on another member of the same group (metonym).

EXAMPLES.—*Meibomia* Heist. ex Adans. Fam. Pl. **2**: 509 (1763), is based on *Hedysarum canadense* L. Sp. Pl. 748, and *Desmodium* Desv. Jour. de Bot. II. **1**: 122 (1813), is typified by *Hedysarum asperum* Poir. Encycl. Suppl. **6**: 408 (1804), consequently if these species are regarded as congeneric the name *Desmodium* is to be rejected; *Boletopsis* P. Henn. Nat. Pflanzenf. 1^{1**}: 194 (1899), cannot stand as a genus to include a section bearing the name *Boletinus* Kalchb., the latter having been established as a genus in 1877; *Sisymbrium altissimum* L. Sp. Pl. 659 (1753), *Sisymbrium Sinapistrum* Crantz, Stirp. Austr. ed. 2, 52 (1769), and *Sisymbrium pannonicum* Jacq. Coll. **1**: 70 (1786), have different types, but if these are regarded as belonging to the same species, the two later names are metonyms of that of Linnaeus.

CANON 18. A name is rejected when there is an older valid name based on the same type (typonym).

EXAMPLES.—*Miegia* Pers. Syn. **1**: 101 (1805), is a typonym of *Arundinaria* Michx. Fl. Bor. Am. **1**: 73 (1803), both being based on the same species; *Asplenium Vincentis* Christ, Bot. Jahrb. **24**: 109 (1897), is a typonym of *A. Guildingii* Jenm. Gard. Chron. III. **15**: 70 (1894), both being based on H. H. Smith's *no. 1346* from St. Vincent.

CANON 19. A name is rejected when the natural group to which it applies is undetermined (hyponym).

(*a*) A specific or subspecific name is a hyponym when it has not been connected with a description identifiable by diagnostic characters or by reference to a type specimen, figure or locality.

EXAMPLES.—*Gentiana hybrida* Raf. Med. Rep. II. **5**: 353 (1808), is a hyponym, as no diagnosis is published; *Lechea furfuracea* Raf. New Fl. Am. **1**: 92 (1836), is a hyponym, as its description is not identifiable.

(*b*) A generic or subgeneric name is a hyponym, when it is not associable, at least by specific citation, with a binomial species previously or simultaneously published; or when its type species is not identified.

EXAMPLES.—*Adodendrum* Necker, Elem. **1**: 214 (1790), and *Calesiam* Adans. Fam. Pl. **2**: 446 (1763), are hyponyms, because their authors neither named a binomial species nor cited a species which had previously received a binomial name; *Nudilus* Raf. Atl. Jour. 176 (1833), is a hyponym, as its type species, *N. paradoxus*, has not been identified.

PART III. ORTHOGRAPHY AND CITATION.

Section I. Orthography.

1. The original orthography of names is to be maintained, except in the following cases; the change not to affect priority.

(*a*) Manifest typographical errors may be corrected.

EXAMPLES.—*Scoria* Raf. is a misprint for *Hicoria*; *Rumhora* Raddi is a misprint for *Rumohra*, named for K. von Rumohr.

(*b*) Adjectival names of species and subspecies agree in gender with the generic name with which they are associated.

EXAMPLES.—*Polygonum articulatum* L. = *Polygonella articulata* (L.) Meissn.; *Sisymbrium amphibium palustre* L. = *Roripa palustris* (L.) Bess.

(*c*) Generic names derived from personal names should be feminine, and if originally of other forms should be corrected.

EXAMPLES.—*Lippius* S. F. Gray, *Kantius* S. F. Gray, *Pallavicinius* S. F. Gray, should be changed to *Lippia*, *Kantia*, and *Pallavicinia* and yet date from 1821 when originally published.

(*d*) In the case of names proposed in works in which v and j were used as vowels or u and i as consonants they should be corrected to agree with modern usage.

EXAMPLES.—*Euonymus*, not *Evonymus*; *Naias*, not *Najas*; *Neuropteris*, not *Nevropteris*; *Rivularia*, not *Riuularia* (*Rivvlaria*); *Jungia*, not *Iungia*.

2. Generic names should be written with initial capital letters.

EXAMPLES.—*Desfontainea*, not *desFontainea*; *Durvillaea* not *d' Urvillaea*.

3. If capital letters are to be used for specific names they should be employed only for substantives and for adjectives derived from personal names.

EXAMPLES.—*Asplenium Trichomanes* L.; *Uromyces Trifolii* (Hedw.) Lév.; *Trichomanes Smithii* Hook.; *Galium Boryanum* Walp.

4. The publication of names of bilingual derivation should be avoided, but published names are not to be rejected on account of such derivation.

EXAMPLES. — *Liquidambar* is Latin-Arabic; *Fimbristylis* is Latin-Greek; *Actiniceps* is Greek-Latin.

5. The names of hybrids may be written as follows:

(*a*) A hybrid may be named by placing the names of the

parent species or subspecies in alphabetical order, connected by the sign ×; but in hybrids experimentally produced, or in which the sex of the parents is known, the female parent is to be written first, and the sex indicated by the signs ♀, ♂.

EXAMPLES. — *Carex debilis* × *virescens*; *Digitalis lutea* ♀ × *purpurea* ♂.

(*b*) A hybrid may be named when desirable like a species or subspecies, provided the binomial or trinomial is preceded by the sign ×, designating it as a hybrid.

EXAMPLE. — × *Salix capreola* Kern.

(*c*) A hybrid between species of different genera may be named by attaching the specific name to the generic name of the female parent, or, if the sex of the parents is unknown, to the generic name coming first in alphabetical order.

EXAMPLE. — × *Ammophila baltica* Link = *Ammophila arenaria* × *Calamagrostis Epigeios*.

(*d*) A hybrid derived from parents one or both of which are of hybrid origin, may be named by including the name of the hybrid parent in parentheses.

EXAMPLE. — *Salix* (*aurita* × *repens*) × *cinerea*.

(*e*) Preponderance of one parent over the other may be designated by the signs >, <.

EXAMPLES. — *Mentha longifolia* > × *rotundifolia*; *Mentha longifolia* × < *rotundifolia*.

Section II. Citation of authors.

1. An author-citation following a name refers to the author by whom the name was first published; the author's name may be abbreviated, but never in such a manner as to result in ambiguity.

EXAMPLES. — Spreng. for Sprengel, not Spr., to distinguish from Spruce and others; Michx. for Michaux, not Mich., to distinguish from Micheli; S. Wats. for Sereno Watson, to distinguish from H. C. Watson.

2. In the following cases the name of the original author should appear in parentheses, followed by that of the author who first published the name in its accepted form and application.

(*a*) A specific name originally combined with a different generic name, or a subspecific name originally combined with a different binomial.

EXAMPLES.—***Moneses uniflora*** (L.) A. Gray, for the plant originally described as *Pyrola* ***uniflora*** by Linnaeus and subsequently first published as *Moneses* ***uniflora*** by Asa Gray; *Chondrophora* ***nauseosa glabrata*** (A. Gray) Rydberg for *Bigelovia graveolens* var. ***glabrata*** A. Gray.

(*b*) A generic name adopted through citation from a publication issued prior to the first edition of Linnaeus' Species Plantarum (1753).

EXAMPLES.—*Linnaea* (Gronov.) L.; *Anthoceros* (Mich.) L.; *Valerianella* (Tourn.) Poll.

(*c*) A name applied to a category different from that in which it was first proposed.

EXAMPLES.—*Salix cordata angustata* (Pursh) Anders., originally *Salix angustata* Pursh; *Actaea rubra* (Ait.) Willd., originally *Actaea spicata* var. *rubra* Ait.; *Ardisia* subg. *Pickeringia* (Nutt.) Mez, originally genus *Pickeringia* Nutt.; *Raphidostegium* (Br. & Sch.) De Not., originally *Rhynchostegium* subg. *Raphidostegium* Br. & Sch.

3. A comma between the name of the plant and the name of the author is undesirable.

EXAMPLES.—*Rumex* L., not *Rumex*, L.; *Phacelia congesta* Hook., not *Phacelia congesta*, Hook.; *Ilysanthes dubia* (L.) Barnhart, not *Ilysanthes dubia*, (L.), Barnhart.

CODE DE LA NOMENCLATURE BOTANIQUE

Une Commission de Nomenclature fut nommée par le Club Botanique de l'Association Américaine pour l'Avancement des Sciences, dans une réunion tenue à Washington, D. C., le 2 Janvier, 1903. Dans cette réunion une série de règles de nomenclature était présentée et renvoyée à la Commission, qui a examiné soigneusement tous les principes en jeu, et a essayé l'application de ces principes à toutes sortes de cas. La Commission a trouvé que, dans le but d'obtenir des données plus exactes, et pour arriver à des résultats plus satisfaisants, un nouvel arrangement et quelques modifications aux règles proposées à cette réunion de Washington étaient jugés convenables. Les principes ont été soigneusement comparés à ceux qui ont été énoncés dans les Lois de la Nomenclature adoptées au Congrès de Botanique de Paris en 1867, et au Congrès de Botanique réuni à Gênes en 1892, ainsi qu'aux propositions faites par divers groupes de botanistes et par des particuliers, pendant les quelques années passées ; les méthodes suivies par les zoologistes ont été également étudiées ; le tout, en vue d'obtenir un code de nomenclature qui puisse satisfaire aussi bien que possible tous les interêts en jeu. L'action du Congrès international de Botanique tenu à Paris en 1900, d'après laquelle le sujet de la nomenclature doit être soumis au Congrès international devant avoir lieu à Vienne en 1905, a été prise en considération, et la décision prise à ce Congrès de baser un nouveau système de règles sur celles qui avaient été adoptées par le Congrès de Paris en 1867, a reçu notre attention toute spéciale. Cette action projette la modification des Lois de Paris de 1867, dans ses différents articles, par amendement, suppression ou substitution. Nous avons trouvé, d'ailleurs, que les Lois de Paris de 1867 ne peuvent s'adapter d'une manière satisfaisante à la modification ci-dessus indiquée, pour les raisons suivantes : que leur disposition n'est pas philosophique à en juger par l'expérience et les connaissances modernes ; que beaucoup de principes importants n'y sont pas reconnus ou y reçoivent en somme une considération trop restreinte ; et qu'il s'y rencontre un manque

d'exposé exact et défini, lequel conduit à l'équivoque. Nous recommandons donc, et avons l'intention de proposer au Congrès de Vienne en 1905, que conformément aux dispositions du comité d'organisation du Congrès de 1905, le code de lois de 1867 soit amendé par la suppression de tous ses articles et la substitution du code ci-joint.

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MEMBRES ET SUBSTITUTS DE LA COMMISSION DE NOMENCLATURE.

CODE DE LA NOMENCLATURE BOTANIQUE

Partie I. Principes.

1. Le but principal d'une nomenclature formelle en biologie systématique est d'obtenir la stabilité, l'uniformité et la facilité dans la désignation des plantes et des animaux.
2. La nomenclature botanique est considérée comme commençant avec l'application générale de noms binaires aux plantes (Linné, Species Plantarum, 1753).
3. La priorité de publication est un principe fondamental de nomenclature botanique. Deux groupes de la même catégorie ne peuvent pas avoir le même nom.

   Note. — L'emploi antérieur d'un nom en zoologie n'exclut pas son emploi en botanique.

4. L'application d'un nom est déterminée par rapport à son type de nomenclature.

Partie II. Canons.

Section I. Catégories de Classification.

Canon 1. Groupes alliés ou cohérents d'individus se nomment espèces.

Canon 2. Les espèces sont groupées en genres ; les genres en tribus ; les tribus en familles ; les familles en ordres ; les ordres en classes ; les classes en phyla.

Note. — Ordre est préférable à cohorte, et phylum à division, conformément à l'usage zoologique.

Canon 3. Lorsque des catégories additionnelles sont nécessaires pour la présentation commode des relations, on les obtient en reconnaissant des groupes intermédiaires dont les noms se forment en ajoutant le préfixe sous- aux noms des catégories principales ci-dessus.

Exemples. — Sous-espèce, sous-genre, sous-famille, sous-ordre.

Canon 4. D'autres expressions telles que groupe, section, série, division et embranchement, peuvent être employées pour un arrangement temporaire plus commode subordonné aux catégories ci-dessus, mais leurs noms ne peuvent être valides en taxinomie formelle.

Note. — L'expression variété est reléguée à l'usage horticole.

Section II. Formation des Noms.

CANON 5. Les noms spécifiques et sous-spécifiques consistent en adjectifs ou substantifs latins, ou latinisés, ces derniers étant soit des nominatifs en apposition, ou des génitifs.

EXEMPLES. — *Hookerianus ; europaeus ; vulgaris ; heterophyllus; malvicola; Tulipifera ; Tuna ; Engelmanni ; Sonorae ; Trifolii.*

CANON 6. Les noms génériques et sous-génériques consistent en substantifs latins ou latinisés, ou en mots équivalents.

EXEMPLES. — *Rosa ; Convolvulus ; Hedysarum ; Bartramia ; Liquidambar ; Couroupita ; Tsuga ; Gloriosa ; Impatiens ; Manihot.*

CANON 7. Les noms des sous-tribus, ordres, et groupes intermédiaires sont formés des noms des genres constituants.

(*a*) Pour les noms de tribus ajouter -eae, de familles -aceae, d'ordres -ales, au thème du nom générique.

EXEMPLES. — *Roseae ; Rosaceae ; Rosales.*

(*b*) Pour les noms de sous-tribus ajouter -anae, de sous-familles -atae, de sous-ordres -ares, au thème du nom générique.

EXEMPLES. — *Rosanae ; Rosatae ; Rosares.*

CANON 8. Les noms des sous-classes et groupes plus élevés consistent en substantifs latins ou latinisés, au pluriel.

EXEMPLES. — *Monocotyledones ; Angiospermae ; Pteridophyta.*

Section III. Publication des Noms.

CANON 9. Un nom spécifique ou sous-spécifique est considéré comme publié quand il a été imprimé et distribué avec une description (ou en paléobotanique une figure), ou bien avec un renvoi à une description publiée antérieurement.

EXEMPLES. — *Coursetia arborea* Griseb. Fl. Brit. W. Ind. 183 (1859), est publié avec une description ; *Cynanchum nivale* Nym. Syll. Fl. Eur. 108 (1855), est publié avec un renvoi à *Vincetoxicum nivale* Boiss. & Heldr., publié antérieurement ; *Pterospermites Whitei* Ward, Ann. Rep. U. S. Geol. Surv. **6** : 556. *pl. 56, f. 5, 6* (1885), une espèce fossile, est publiée avec figure, mais sans description.

(*a*) Les noms publiés pour des subdivisions primaires d'espèces sont considérés comme des noms sous-spécifiques, de quelque manière qu'ils aient été désignés par leur auteur.

EXEMPLES. — *Juglans alba minima* Marsh. Arb. Am. 68 (1785) ; *Scirpus maritimus β fluviatilis* Torr. Ann. Lyc. N. Y. **3** : 324 (1836) ; *Zizia aurea* var. *Bebbii* Coult. & Rose, Bot. Gaz. **12** : 138 (1887) ; ces

exemples montrent des divisions primaires d'espèces qu'on peut reconnaître comme sous-espèces.

(*b*) Dans le transfert d'une espèce d'un genre dans un autre, on maintient le nom princeps spécifique à moins que le nom binaire résultant n'ait été publié antérieurement.

EXEMPLES. — *Bromus giganteus* L. Sp. Pl. 77, est *Festuca gigantea* (L.) Vill. Hist. Pl. Dauph. **2** : 110 (1787) ; *Arum triphyllum* L. Sp. Pl. 965, doit être connu sous le nom de *Arisaema triphyllum* (L.) Torr. Fl. N. Y. **2** : 239 (1843), et non de *Arisaema atrorubens* Blume, Rumphia, **1** : 97 (1835) ; *Laurus Sassafras* L. Sp. Pl. 371, doit être connu sous le nom de *Sassafras Sassafras* (L.) Karst. Deutsch. Fl. 505 (1881), et non de *Sassafras officinale* Nees & Eberm. Handb. Med.-pharm. Bot. **2** : 418 (1831) ; cependant, *Schoenus pusillus* Sw. Nov. Gen. & Sp. Pl. 20 (1788), quand on le transfère à *Rynchospora*, ne doit pas être connu sous le nom de *Rynchospora pusilla* (Sw.) Griseb. Kar. 123 (1857), parce que avant 1857, le même nom binaire avait été employé pour une autre espèce, *Rynchospora pusilla* Chapm. (1849).

(*c*) Une sous-espèce élevée au rang d'espèce conserve le même nom à moins que le nom binaire résultant n'ait été publié antérieurement.

EXEMPLES. — *Sparganium simplex androcladum* Engelm. in A. Gray, Man. ed. 5, 481 (1867), si on le considère comme une espèce distincte, devient *Sparganium androcladum* (Engelm.) Morong, Bull. Torrey Club, **15** : 78 (1888) ; cependant, *Juncus acuminatus robustus* Engelm. Trans. Acad. Sci. St. Louis, **2** : 463 (1868), ne devient pas *Juncus robustus* (Engelm.) Coville in Britt. & Brown, Ill. Fl. **1** : 395 (1896), parce que avant 1896, le nom binaire avait été employé pour une autre espèce, *Juncus robustus* S. Wats. Proc. Am. Acad. **14** : 302 (1879).

CANON 10. Un nom générique ou sous-générique est considere comme publié quand il a été imprimé et distribué (1) avec une description générique ou spécifique (ou en paléobotanique une figure) et un nom binaire spécifique, (2) avec un nom générique et spécifique et la citation d'une description publiée antérieurement, ou (3) avec un renvoi à une description spécifique, qu'on peut associer par citation à une espèce binaire publiée antérieurement.

EXEMPLES. — *Pachysandra* Michx. Fl. Bor. Am. **2** : 177 (1803), est publié avec une description générique et spécifique et un nom binaire spécifique ; *Brasenia* Schreb. ex Gmel. Syst. **2** : 853 (1791), est publié avec une description générique et un nom binaire spécifique ; *Silphium* L. Sp. Pl. 919 (1753), est publié avec une description spécifique et un nom binaire spécifique ; *Poacites* Schloth. Petrefact. 416. *pl. 26, f. 1, 2* (1820), un genre fossile, est publié avec

figures et un nom binaire spécifique, mais sans description ; *Nyssa* L. Sp. Pl. 1058 (1753), est publié avec un nom générique et spécifique et la citation d'une description publiée antérieurement ; *Dryopteris* Adans. Fam. Pl. **2** : 20 (1763), est publié avec renvoi à une description spécifique qu'on peut associer par citation avec *Polypodium Filix-mas* L. Sp. Pl. 1090 (1753), publié antérieurement, puisque Adanson et Linné citent tous deux *Filix mas* de Fuchs.

CANON 11. Les noms de sous-tribus, ordres et groupes intermédiaires sont considérés comme publiés quand ils ont été imprimés et distribués avec citation directe ou indirecte des genres constituants.

EXEMPLES. — *Moraceae* Lindl. Veg. Kingd. 266 (1847), est publié avec citation des genres constituants ; *Ophioglossales* Engler, Syll. ed. 2, 63 (1898), est publié avec citation des genres constituants.

CANON 12. Un nom n'est pas considéré comme publié par sa seule citation en synonymie, ou par une mention casuelle.

EXEMPLES. — *Echeveria spicata*, cité par DeCandolle, Prodr. **3** : 349 (1828), comme synonyme de *Fouquiera formosa*, n'est pas publié, et ne rend pas invalide *Echeveria* DC., publié à la page 401 du même volume ; *Acrostichum Plumieri* "Desv. herb.", cité comme synonyme de *A. viscosum* dans Fée, Mém. Fam. Foug. **2** : 46 (1845), n'est pas publié, et ne rend pas invalide *Acrostichum Plumieri* Fée, publié comme espèce à la page 50 du même ouvrage ; *Hormisus opuntioides* Targ., cité par Bertoloni, Amoen. Ital. 316 (1819), comme synonyme de *Fucus Sertolara* Bertol. (= *Halimeda Tuna*), n'est pas publié par ce seul fait.

CANON 13. Parmi les noms publiés dans le même ouvrage et en même temps, ceux qui ont la précédence de position seront considérés comme ayant la priorité.

EXEMPLES. — *Alsine* L. Sp. Pl. 272, doit être considéré comme ayant la priorité sur *Stellaria* L. Sp. Pl. 421 ; *Aira spicata* L. Sp. Pl. 63, doit être considéré comme ayant la priorité sur *Aira spicata* L. Sp. Pl. 64 ; *Hibiscus Moscheutos* L. Sp. Pl. 693, doit être considéré comme ayant la priorité sur *H. palustris*, qu'il précède à la même page.

Section IV. Application des Noms.

CANON 14. Le type de nomenclature d'une espèce ou sous-espèce est le spécimen auquel l'auteur de la description a appliqué le nom originellement, lors de la publication.

EXEMPLES. — *Polypodium marginale* L. Sp. Pl. 1091, est typifié par la désignation d'un spécimen recueilli au Canada par Kalm ; *Stachys arenicola* Britton, Man. 792 (1901), est typifié par la désignation d'un spécimen venant de Staten Island, New York ; *Carex intumescens Fernaldii* Bailey, Bull. Torrey Club, **20** : 418 (1893), est typifié par un spécimen recueilli à Cedar Swamp, Aroostook County, Maine, par M. L. Fernald.

(*a*) Lorsque plus d'un spécimen ont été cités originairement, le type ou groupe de spécimens dans lequel le type est compris peut être indiqué par la dérivation du nom de celui du collecteur, de la localité ou de l'hôte.

EXEMPLES. — *Eriogonum Porteri* Small, Bull. Torrey Club, **25**: 41 (1898), est basé sur plusieurs spécimens, dont le type est celui qui a été recueilli par T. C. Porter; *Gaillardia arizonica* A. Gray, Syn. Fl. N. Am. 1²: 353 (1884), est basé sur plusieurs spécimens, dont le type est celui qui a été recueilli dans l'Arizona par Palmer; *Cuscuta Cephalanthi* Engelm. Am. Jour. Sci. **43**: 336 (1842), est basé sur des spécimens provenant de plusieurs hôtes, dont le type est celui qui provient de *Cephalanthus*.

(*b*) Entre les spécimens éligibles au même degré, le type est celui figuré avec la description originale, ou à défaut de figure le premier mentionné.

EXEMPLES. — *Calyptridium roseum* S. Wats. Bot. King's Exp. 44. *pl. 6, f. 6–8* (1871), est basé sur au moins trois spécimens dont celui qui est figuré est le type; *Arnica cordifolia* Hook. Fl. Bor. Am. 1: 331 (1833), est basé sur deux spécimens, ni l'un ni l'autre figurés, et le premier mentionné, celui qui a été recueilli par Drummond dans les bois alpins des Montagnes Rocheuses, est le type.

(*c*) À défaut de spécimen original, celui qui est représenté par la première figure citée, dont on peut prouver l'identité, ou à défaut de figure, par la première description citée, ou publiée postérieurement, sert de type.

EXEMPLES. — *Trillium sessile* L. Sp. Pl. 340, est basé sur trois citations, dont la seconde typifie l'espèce, étant accompagnée d'une figure; *Centaurea Scabiosa* L. Sp. Pl. 913, est basé sur un nombre de citations, dont la première mentionnée est le type, puisque on ne cite pas de figure.

CANON 15. Le type de nomenclature d'un genre ou sous-genre est l'espèce nommée ou désignée originellement par l'auteur du nom. Si aucune espèce n'a été désignée, le type est la première espèce binaire après l'application des conditions suivantes:

(*a*) Le type doit être choisi dans un sous-genre, une section, ou autre liste d'espèces désignées originellement comme typiques.

EXEMPLES. — *Psilogramme* Kuhn, Festschr. 50-Jähr. Jub. Königs. Realschule zu Berlin, 332 (1882), est typifié par l'espèce mentionnée en premier lieu dans la seconde section *Eupsilogramme*, et non d'après des espèces comprises dans la première section *Jamesonia*, qui est basée sur un nom générique publié antérieurement; *Phania* DC. Prodr. **5**: 114

(1826), est typifié par *P. multicaulis* DC., la seule espèce de la section *Euphania*.

(*b*) Une espèce figurée doit être choisie plutôt qu'une espèce sans figure, dans le même ouvrage ; ou bien en cas d'absence de figure, on doit donner la préférence à une espèce accompagnée par la citation d'une figure.

EXEMPLES. — *Lespedeza* Michx. Fl. Bor. Am. **2** : 70 (1803), est typifié par *L. procumbens* Michx. *loc. cit. pl. 39*, l'espèce figurée en premier lieu ; *Basanacantha* Hook. f. in Benth. & Hook. Gen. Pl. **2** : 82 (1873), est typifié par *Randia tetracantha* (Cav.) DC., la seconde espèce citée, car cette espèce a été figurée par Cavanilles, tandis que *Randia Humboldtiana* DC., l'espèce mentionnée la première par Hooker, n'avait pas été figurée.

(*c*) Les types de genres adoptés au moyen de citations de textes nonbinaires (avec ou sans changement de nom) doivent être choisis parmi ceux des espèces originales qui reçoivent des noms dans la première publication binaire. Les genres du Species Plantarum de Linné (1753) doivent être typifiés au moyen des citations données dans son Genera Plantarum (1754).

NOTE. — Le Species Plantarum ne contient aucune référence générique, tandis que l'édition de 1754 du Genera Plantarum était évidemment préparée en même temps et était en effet un volume complémentaire de l'ouvrage précédent. Le dernier ouvrage s'accorde beaucoup mieux que d'autres éditions avec le traitement suivi dans le Species Plantarum, et permet ainsi de conserver, un plus grand nombre des noms génériques de Linné dans leur application courante.

EXEMPLES. — *Cypripedium* L. Sp. Pl. 951, un genre adopté d'après Tournefort, avec changement du nom *Calceolus* qu'il emploie, est typifié par *Cypripedium Calceolus*, la seule espèce commune aux deux auteurs ; *Seseli* L. Sp. Pl. 259, un genre adopté d'après Boerhaave typifié par la seconde espèce de Linné, *Seseli montanum*, qui est la première des espèces de Linné commune aux deux auteurs ; *Silene* L. Sp. Pl. 416, un genre adopté d'après Dillenius, avec changement du nom *Viscago* qu'il emploie, est typifié par *Silene anglica*, qui est la première de Linné des treize espèces figurées par Dillenius ; *Fritillaria* L. Sp. Pl. 303, un genre adopté d'après Tournefort, est typifié par la quinquième espèce de Linné, *Fritillaria Meleagris*, qui est une des trois espèces de *Fritillaria* communes aux deux auteurs, et elle est choisie parce qu'elle est l'espèce figurée par Tournefort.

(*d*) Quand un nom générique pré-binaire est déplacé par la publication d'un nom générique compris dans l'usage binaire, l'application du nom déplacé à une espèce sous le nouveau nom générique désigne le type.

EXEMPLE. — *Dianthus* L. Sp. Pl. 409, un genre adopté d'après Tournefort avec changement du nom *Caryophyllus* qu'il emploie, est typifié par *Dianthus Caryophyllus*, une des quinze espèces originales de Linné.

(*e*) L'application à un genre d'un ancien nom spécifique d'une des espèces comprises, désigne le type.

EXEMPLES. — *Amsonia* Walt. Fl. Car. 98 (1788), est typifié par *Tabernaemontana Amsonia* L., une de ses deux espèces originales; *Sordaria* Ces. & DeN. Comm. Soc. Critt. Ital. 1 : 225 (1863), est typifié par *Sphaeria Sordaria* Fr., une de ses douze espèces originales.

(*f*) Pour éviter le changement dans l'application courante d'un nom générique de Linné, une espèce utile bien connue peut être choisie comme type selon le principe énoncé par Linné (Phil. Bot. 197. 1751): "Si genus receptum, secundum jus naturae et artis, in plura dirimi debet, tum nomen antea commune manebit vulgatissimae et officinali plantae."

EXEMPLES. — *Poa* L. Sp. Pl. 67, est typifié par *P. pratensis* L., la plus commune des espèces originales; *Mollugo* L. Sp. Pl. 89, est typifié par *M. verticillata* L., la plus commune des espèces originales.

Section V. Rejet des Noms.

CANON 16. Un nom est rejeté quand il a été employé antérieurement (homonyme).

(*a*) Un nom spécifique ou sous-spécifique est un homonyme quand il a été publié pour une autre espèce sous le même nom générique. Deux sous-espèces du même genre ne doivent pas conserver le même nom.

EXEMPLES. — *Acer saccharinum* Wang. Amer. 36. *pl. 2, f. 26* (1787), est l'homonyme de *Acer saccharinum* L. Sp. Pl. 1055 (1753); *Vaccinium myrtilloides* Hook. Fl. Bor. Am. 2 : 32 (1834), est l'homonyme de *Vaccinium myrtilloides* Michx. Fl. Bor. Am. 1 : 234 (1803), et doit être rejeté, que l'on considère cette dernière espèce comme distincte ou non; *Juncus nodosus megacephalus* Torr. Fl. N. Y. 2 : 326 (1843), est l'homonyme de *Juncus megacephalus* M. A. Curtis, Boston Jour. Nat. Hist. 1 : 132 (1835); *Chrysopsis pilosa* (Walt.) Britton, Mem. Torrey Club, 5 : 316 (1894), est l'homonyme de *Chrysopsis pilosa* Nutt. Jour. Acad. Nat. Sci. Phila. 7 : 66 (1834), et doit être rejeté, malgré le fait que *Erigeron pilosum* Walt. fut publié en 1788; *Carex scoparia moniliformis* Tuckerm. Enum. Meth. Car. 17 (1843), et *Carex straminea moniliformis* Tuckerm. *loc. cit.*, ne peuvent être conservés tous deux.

(*b*) Un nom générique ou sous-générique est un homonyme quand il a été publié antérieurement, ou proposé dans un texte imprimé, pour un autre genre.

EXEMPLES. — *Torreya* Arn. Ann. Nat. Hist. **1** : 130 (1838), est l'homonyme de *Torreya* Raf. Am. Mo. Mag. **3** : 356 (1818), de *Torreya* Raf. Jour. de Phys. **89** : 105 (1819), de *Torreya* Spreng. Neue Entdeck. **2** : 121 (1821), et de *Torreya* Eat. Man. ed. 5, 420 (1829) ; *Rivularia* Ag. Syn. Alg. Scand. xxxviii (1817), est l'homonyme de *Rivularia* Roth, Cat. **1** : 212 (1797) ; *Nesaea* Lamour. Nouv. Bull. Soc. Philom. **3** : 185 (1812), est l'homonyme de *Nesaea* Commers. ex Juss. Gen. Pl. 332 (1789) ; *Bulliarda* DC. Bull. Soc. Philom. 3^{69} : 1 (1801), est l'homonyme de *Bulliarda* Neck. Elem. **2** : 321 (1790).

(*c*) Des noms semblables ne seront pas considerés comme homonymes excepté quand ils ne sont que de simples variations de l'orthographe du même mot ; ou bien dans le cas de noms spécifiques et sous-spécifiques quand ils ne diffèrent que par la désinence adjective ou génitive.

EXEMPLES. — *Penicillus* et *Penicillium*, *Callitriche* et *Calothrix*, *Nemastylis* et *Nematostylis*, *Pterigophyllum* et *Pteridophyllum*, peuvent être conservés ; *Cyathophora* et *Cyathophorum*, *Asterocarpus* et *Astrocarpus*, ne peuvent être conservés. *Greenei* et *Greenii*, dérivés denoms d'hommes différents, Greene et Green, peuvent être conservés dans le même genre ; *virginicus*, *virginianus* et *virginiensis*, *oreganus* et *oregonensis*, *Hookeri* et *Hookerianus*, ne peuvent être conservés dans le même genre.

CANON 17. Un nom est rejeté quand il y a un nom valable plus ancien, basé sur un autre membre du même groupe (métonyme).

EXEMPLES. — *Meibomia* Heist. ex Adans. Fam. Pl. **2** : 509 (1763), est basé sur *Hedysarum canadense* L. Sp. Pl. 748, et *Desmodium* Desv. Jour. de Bot. II. **1** : 122 (1813), est typifié par *Hedysarum asperum* Poir. Encycl. Suppl. **6** : 408 (1804), par conséquent si ces espèces sont considérées comme congénériques le nom *Desmodium* doit être rejeté ; *Boletopsis* P. Henn. Nat. Pflanzenf. 1^{1**} : 194 (1899), ne peut être maintenu comme genre, une section portant le nom *Boletinus* Kalchb., ce dernier ayant été établi comme genre en 1877 ; *Sisymbrium altissimum* L. Sp. Pl. 659 (1753), *Sisymbrium Sinapistrum* Crantz, Stirp. Austr. ed. 2, 52 (1769), et *Sisymbrium pannonicum* Jacq. Coll. **1** : 70 (1786), ont des types différents, mais si ceux-ci sont considérés comme appartenant à la même espèce, les deux derniers noms sont des métonymes de celui de Linné.

CANON 18. Un nom est rejeté quand il y a un nom valable plus ancien basé sur le même type (typonyme).

EXEMPLES. — *Miegia* Pers. Syn. **1** : 101 (1805), est le typonyme de *Arundinaria* Michx. Fl. Bor. Am. **1** : 73 (1803), tous deux étant basés sur la même espèce ; *Asplenium Vincentis* Christ, Bot. Jahrb. **24** : 109 (1897), est le typonyme de *A. Guildingii* Jenm. Gard. Chron. III. **15** : 70 (1894), tous deux étant basés sur le *no. 1346* de H. H. Smith, provenant de St. Vincent.

CANON 19. Un nom est rejeté quand le groupe naturel auquel le nom applique est indéterminé (hyponyme).

(*a*) Un nom spécifique ou sous-spécifique est un hyponyme quand il n'a pas été rattaché à une description qui peut être identifiée par des caractères diagnostiques ou par renvoi à un spécimen, à une figure ou à une localité typique.

EXEMPLES. — *Gentiana hybrida* Raf. Med. Rep. II. 5 : 353 (1808), est un hyponyme, car aucun diagnose n'en est publié ; *Lechea furfuracea* Raf. New Fl. Am. 1 : 92 (1836), est un hyponyme, car on ne peut en identifier la description.

(*b*) Un nom générique ou sous-générique est un hyponyme quand on ne peut le rattacher, tout au moins par une citation spécifique, à une espèce binaire publiée antérieurement ou simultanément ; ou bien quand son espèce typique n'est pas identifiée.

EXEMPLES. — *Adodendrum* Necker, Elem. 1 : 214 (1790), et *Calesiam* Adans. Fam. Pl. 2 : 446 (1763), sont hyponymes, car leurs auteurs n'ont ni nommé d'espèce binaire, ni cité d'espèce qui ait reçu antérieurement un nom binaire ; *Nudilus* Raf. Atl. Jour. 176 (1833), est un hyponyme, car son espèce typique, *N. paradoxus*, n'a pas été identifiée.

PARTIE III. ORTHOGRAPHE ET CITATION.

Section I. Orthographe.

1. L'orthographe originale des noms doit être maintenue excepté dans les cas suivants ; le changement ne devant en aucun cas porter atteinte à la priorité.

(*a*) Les erreurs typographiques évidentes peuvent être corrigées.

EXEMPLES. — *Scoria* Raf. est une faute d'impression au lieu de *Hicoria ; Rumhora* Raddi est une faute d'impression pour *Rumohra*, nommé d'après K. von Rumohr.

(*b*) Noms de forme adjective d'espèces et de sous-espèces s'accordent en genre avec le nom générique auquel ils sont associés.

EXEMPLES. — *Polygonum articulatum* L. = *Polygonella articulata* (L.) Meissn. ; *Sisymbrium amphibium palustre* L. = *Roripa palustris* (L.) Bess.

(*c*) Les noms génériques dérivés de noms de personnes doivent être féminins, et s'ils ont une autre forme primitive doivent être corrigés.

EXEMPLES. — *Lippius* S. F. Gray, *Kantius* S. F. Gray, *Pallavicinius* S. F. Gray, devraient être changés en *Lippia*, *Kantia*, et *Pallavicinia*, et néanmoins conserver la date de 1821, quand ils furent d'abord publiés.

(*d*) Dans le cas de noms proposés dans des ouvrages ou le v et le j sont employés comme voyelles, ou l'u et l'i comme consonnes, on doit les corriger pour les faire accorder avec l'usage moderne.

EXEMPLES. — *Euonymus* et non *Evonymus*; *Naias* et non *Najas*; *Neuropteris* et non *Nevropteris*; *Rivularia* et non *Riuularia* (*Rivvlaria*); *Jungia* et non *Iungia*.

2 Les noms génériques doivent toujours commencer par des majuscules.

EXEMPLES. — *Desfontainea* et non *desFontainea*; *Durvillaea* et non *d'Urvillaea*.

3. Si les majuscules doivent être employées pour les noms spécifiques, on doit les employer seulement pour les substantifs ou pour les adjectifs dérivés de noms d'hommes.

EXEMPLES. — *Asplenium Trichomanes* L.; *Uromyces Trifolii* (Hedw.) Lév.; *Trichomanes Smithii* Hook.; *Galium Boryanum* Walp.

4. On devrait éviter la publication de noms dérivés de deux langues, mais des noms déjà publiés ne seront pas rejetés à cause d'une telle dérivation.

EXEMPLES. — *Liquidambar* est Latin-Arabe; *Fimbristylis* est Latin-Grec; *Actiniceps* est Grec-Latin.

5. Les noms d'hybrides peuvent être écrits comme il suit :

(*a*) Un hybride peut être désigné en plaçant les noms des espèces parentes par ordre alphabétique et en réunissant par le signe × ; mais dans les hybrides d'origine expérimentale, ou dans lesquels le sexe des parents est connu, le parent femelle doit être écrit le premier, et le sexe indiqué par les signes ♀, ♂.

EXEMPLES. — *Carex debilis* × *virescens*; *Digitalis lutea* ♀ × *purpurea* ♂.

(*b*) Un hybride peut être désigné, si l'on veut, comme une espèce ou sous-espèce, pourvu que le nom binaire ou trinaire soit précédé du signe ×, pour indiquer que c'est un hybride.

EXEMPLE. — × *Salix capreola* Kern.

(*c*) Un hybride entre des espèces de genres différents peut être désigné en ajoutant le nom spécifique au nom générique qui précède l'autre dans l'ordre alphabétique.

EXEMPLE. — × *Ammophila baltica* Link = *Ammophila arenaria* × *Calamagrostis Epigeios*.

(*d*) Un hybride provenant de parents dont un ou tous deux sont hybrides d'origine, peut être désigné en intercalant le nom du parent hybride entre parenthèses.

EXEMPLE. — *Salix* (*aurita* × *repens*) × *cinerea*.

(*e*) La prépondérance de l'un ou de l'autre parent peut être indiquée par les signes >,<.

EXEMPLES. — *Mentha longifolia* >× *rotundifolia*; *Mentha longifolia* ×< *rotundifolia*.

Section II. Citation d'auteurs.

1. Une citation d'auteur suivant un nom indique l'auteur par qui le nom a été publié le premier ; le nom de l'auteur peut être abrégé mais jamais de manière à causer une équivoque.

EXEMPLES. — Spreng. pour Sprengel, et non Spr., afin de distinguer de Spruce et d'autres ; Michx. pour Michaux, et non Mich., afin de distinguer de Micheli ; S. Wats. pour Sereno Watson, afin de distinguer de H. C. Watson.

2. Dans les cas suivants le nom de l'auteur primitif doit être cité entre parenthèses, suivi par celui de l'auteur qui le premier a publié le nom sous sa forme et application acceptées.

(*a*) Dans le cas d'un nom spécifique combiné d'abord avec un nom générique différent, ou un nom sous-spécifique combiné d'abord avec un nom binaire différent.

EXEMPLES. — *Moneses uniflora* (L.) A. Gray, pour la plante originairement décrite comme *Pyrola uniflora* par Linné et ensuite publiée pour la première fois comme *Moneses uniflora* par Asa Gray ; *Chondrophora nauseosa glabrata* (A. Gray) Rydberg, pour *Bigelovia graveolens* var. *glabrata* A. Gray.

(*b*) Dans le cas d'un nom générique adopté par citation d'après un ouvrage publié avant la première édition du Species Plantarum de Linné (1753).

EXEMPLES. — *Linnaea* (Gronov.) L. ; *Anthoceros* (Mich.) L. ; *Valerianella* (Tourn.) Poll.

(*c*) Dans le cas d'un nom appliqué à une catégorie différente de celle dans laquelle il a été proposé d'abord.

EXEMPLES. — *Salix cordata angustata* (Pursh) Anders., originairement *Salix angustata* Pursh ; *Actaea rubra* (Ait.) Willd., originairement *Actaea spicata* var. *rubra* Ait.; *Ardisia* subg. *Pickeringia* (Nutt.) Mez originairement genre *Pickeringia* Nutt.; *Raphidostegium* (Br. & Sch.) De Not., originairement *Rhynchostegium* subg. *Raphidostegium* Br. & Sch.

3. Une virgule entre le nom de la plante et le nom de l'auteur n'est pas à désirer.

EXEMPLES. — *Rumex* L., et non *Rumex*, L.; *Phacelia congesta* Hook., et non *Phacelia congesta*, Hook.; *Ilysanthes dubia* (L.) Barnhart, et non *Ilysanthes dubia*, (L.), Barnhart.

KODEX DER BOTANISCHEN NOMENKLATUR

In der Versammlung des botanischen Clubs der amerikanischen Gesellschaft zur Beförderung der Wissenschaften, gehalten am 2ten Januar, 1903, zu Washington, D. C., wurde eine Kommission für Nomenklatur ernannt. In dieser Versammlung wurde eine Reihe von Regeln vorgeschlagen und an dieser Kommission verwiesen, welche alle in Betracht kommenden Prinzipien und die Anwendung derselben in jeder Richtung einer sorgfältigen Prüfung unterzogen hat. Zum Zwecke einer mehr präcisen Formulation und um zu einem befriedigenden Resultate zu gelangen fand diese Kommission dass eine neue Anordnung und eine Modification der auf der in Washington gehaltenen Versammlung vorgeschlagenen Regeln anzurathen sei. Diese Prinzipien wurden sorgfältig verglichen mit denen enthalten in den Regeln der Nomenklatur angenommen auf den botanischen Kongressen in 1867 in Paris und in 1892 in Genua, ebenso mit Vorschlagen wie sie von verschiedenen Gruppen von Botanikern sowol wie von Einzelnen während der letzten Jahre gemacht waren; auch wurden die Methoden der Zoologen einem sorgfältigen Studium unterworfen — alles dieses für den alleinigen Zweck, um einen Kodex der Nomenklatur auszuarbeiten, der im Interesse aller Theile möglichst zufriendenstellend ist. Der Beschluss des Internationalen Kongresses zu Paris in 1900, nachdem die Nomenklatur auf den in 1905 in Wien abzuhaltenden Kongress aufgenommen werden sollte, wurde von der Kommission besonders in Erwägung gezogen und der damals angenommene Beschluss auf den vom Pariser Kongress von 1867 adoptirten Regeln neue Gesetze zu bauen wurde gleichfalls sorgfältigst erwogen. Dieser Beschluss bedingt eine Modification der Pariser Gesetze durch Verbesserung, Abschaffung oder Substitution verschiedener Artikel. Wir haben jedoch gefunden dass die Pariser Gesetze von 1867, genau genommen, sich den vorgeschlagenen Aenderungen nicht anbequemen, da deren Anordnung im Lichte der neueren Erfahrungen und neueren Wissens nicht rational ist, und weil viele wichtige Prinzipien entweder nicht anerkannt oder in zu oberflächlicher Erwägung gezogen sind; und

endlich, da ein Mangel von klarer Präcision viele in Zweifel lässt. Wir befürworten daher und beabsichtigen auf dem Wiener Kongress von 1905 den Vorschlag zu machen dass der Kodex von 1867, in Uebereinstimmung mit den Verfügungen des Kommittees für Organisation des Kongresses von 1905, dahin verbessert werde dass alle seine Artikel gestrichen und der beigefügte Kodex substituirt werde.

J. C. ARTHUR, *Professor der Pflanzen-Physiologie und Pathologie, Purdue University.*

JOHN HENDLEY BARNHART, *Redacteur des Torrey Botanical Club.*

N. L. BRITTON, *Direktor, New York Botanical Garden.*

STEWARDSON BROWN, *Konservator der Botanischen Abtheilung, Academy of Natural Sciences of Philadelphia.*

FREDERIC E. CLEMENTS, *Hilfs-Professor der Botanik, University of Nebraska.*

O. F. COOK, *Chef der Abtheilung für Botanische Untersuchungen in tropischer Agrikultur, U. S. Department of Agriculture; Hilfs-Kurator (Kryptogamen), U. S. National Herbarium.*

JOHN M. COULTER, *Professor der Botanik, University of Chicago; Redacteur der Botanical Gazette.*

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F. S. EARLE, *Direktor, Estación Agronómica Central de Cuba.*

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WILLIAM ALPHONSO MURRILL, *New York Botanical Garden.*

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WILLIAM TRELEASE, *Direktor, Missouri Botanical Garden.*

LUCIEN M. UNDERWOOD, *Professor der Botanik, Columbia University.*

DAVID WHITE, *U. S. Geological Survey; Kustos (Paläozoische Pflanzen), U. S. National Museum.*

WILLIAM F. WIGHT, *Botanische Abtheilung (Geographische Botanik), U. S. Department of Agriculture.*

MITGLIEDER UND STELLVERTRETER DER KOMMISSION FÜR NOMENKLATUR.

KODEX DER BOTANISCHEN NOMENKLATUR

Teil I. Prinzipien.

1. Dauerhaftigkeit, Einheitlichkeit, und Bequemlichkeit in der Benennung von Pflanzen und Tieren zu sichern ist der Hauptzweck formeller Nomenklatur in systematischer Biologie.
2. Die allgemeine Anwendung von binären Namen zur Bezeichnung von Pflanzen (Linné's Species Plantarum, 1753) wird als der Anfangspunkt botanischer Nomenklatur betrachtet.
3. Publikationspriorität ist ein Grundprinzip botanischer Nomenklatur. Zwei Gruppen ein und derselben Kategorie können nicht denselben Namen tragen.

   Anmerkung. — Der vorhergehende Gebrauch eines Namens in der Zoologie schliesst dessen Gebrauch in der Botanik nicht aus.

4. Die Anwendung eines Namens ist durch Hinweis auf den nomenklatorischen Typus bestimmt.

Teil II. Regeln.

Sektion I. Kategorien der Klassifikation.

Regel 1. Verbundene oder zusammenhängende Gruppen von Individuen werden als Arten bezeichnet.

Regel 2. Arten werden in Gattungen gruppirt; Gattungen in Tribus; Tribus in Familien; Familien in Ordnungen; Ordnungen in Klassen; Klassen in Phyla.

Anmerkung. — Dem zoologischem Gebrauch gemäss ist Ordnung dem Namen Kohorte vorzuziehen, und Phylum dem Namen Division vorzuziehen.

Regel 3. Wenn noch weitere Kategorien zur bequemlichen Bezeichnung von Verwandtschaftsverhältnissen notwendig sind, dann sind dieselben durch die Anerkennung von Zwischengruppen deren Namen durch die Hinzufügung des Präfixes "unter" zu den Namen der oben benannten Hauptkategorien gebildet werden zu erlangen.

Beispiele. — Unterart, Untergattung, Unterfamilie, Unterordnung.

Regel 4. Andere Bezeichnungen, wie Gruppe, Sektion, Reihe, Division, und Abteilung können zur bequemeren temporären Anordnung in den oben benannten Kategorien angewandt werden aber diese Namen haben in formeller Systematik keine Gültigkeit.

ANMERKUNG. — Die Bezeichnung Varietät ist auf den Gebrauch in Gartenkunst verwiesen.

Sektion II. Bildung der Namen.

REGEL 5. Arten- und Unterartennamen bestehen aus lateinischen oder latinisierten Adjektiven oder Substantiven, die letzteren entweder als Nominative in Apposition oder als Genitive.

BEISPIELE. — *Hookerianus; europaeus; vulgaris; heterophyllus; malviecla; Tulipifera; Tuna; Engelmanni; Sonorae; Trifolii.*

REGEL 6. Gattungs- und Untergattungsnamen bestehen aus lateinischen oder latinisierten Substantiven oder gleichwertigen Bezeichnungen.

BEISPIELE. — *Rosa; Convolvulus; Hedysarum; Bartramia; Liquidambar; Couroupita; Tsuga; Gloriosa; Impatiens; Manihot.*

REGEL 7. Die Namen der Untertribus, Ordnungen und Zwischengruppen werden nach einer Gattung derselben Gruppe gebildet.

(*a*) Für die Namen der Tribus fügt man -eae, der Familien -aceae, und der Ordnungen -ales zum Wortstamme des Gattungsnamen.

BEISPIELE. — *Roseae; Rosaceae; Rosales.*

(*b*) Für die Namen der Untertribus fügt man -anae, der Unterfamilien -atae, und der Unterordnungen -ares zum Wortstamme des Gattungsnamens.

BEISPIELE. — *Rosanae; Rosatae; Rosares.*

REGEL 8. Die Namen der Unterklassen und höheren Gruppen bestehen aus pluralen lateinischen oder latinisierten Substantiven.

BEISPIELE. — *Monocotyledones; Angiospermae; Pteridophyta.*

Sektion III. Publikation der Namen.

REGEL 9. Ein Arten- oder Unterartenname gilt als publiziert wenn derselbe in Druckschriften in Verbindung mit einer Beschreibung (in der Paläobotanik mit einer Abbildung) oder mit Hinweis auf eine schon früher publizierte Beschreibung verteilt worden ist.

BEISPIELE. — *Coursetia arborea* Griseb. Fl. Brit. W. Ind. 183 (1859), ist mit einer Beschreibung publiziert; *Cynanchum nivale* Nym. Syll. Fl. Eur. 108 (1855), ist mit Hinweis auf das früher beschriebene *Vincetoxicum nivale* Boiss. & Heldr. publiziert; *Pterospermites Whitei* Ward, Ann. Rep. U. S. Geol. Surv. **6**; 556. *pl. 56, f. 5, 6* (1885), eine fossile Art, ist mit einer Abbildung publiziert, aber ohne Beschreibung.

(*a*) Die für primäre Unterabteilungen von Arten publizierten Benennungen werden als Unterartennamen behandelt wie auch immer dieselben von ihren Autoren betrachtet worden sein mögen.

BEISPIELE. — *Juglans alba minima* Marsh. Arb. Am. 68 (1785); *Scirpus maritimus β fluviatilis* Torr. Ann. Lyc. N. Y. 3 : 324 (1836); *Zizia aurea* var. *Bebbii* Coult. & Rose, Bot. Gaz. 12 : 138 (1887); diese sind primäre Divisionen der Arten, anerkennbar als Unterarten.

(*b*) Wird eine Art von einer Gattung in eine andere versetzt so wird der ursprüngliche Artenname beibehalten, wenn das resultierende Binom nicht schon vorher publiziert worden ist.

BEISPIELE. — *Bromus giganteus* L. Sp. Pl. 77, ist *Festuca gigantea* (L.) Vill. Hist. Pl. Dauph. 2 : 110 (1787); *Arum triphyllum* L. Sp. Pl. 965, muss *Arisaema triphyllum* (L.) Torr. Fl. N. Y. 2 : 239 (1843), genannt werden, nicht *Arisaema atrorubens* Blume, Rumphia, 1 : 97 (1835); *Laurus Sassafras* L. Sp. Pl. 371, muss *Sassafras Sassafras* (L.) Karst. Deutsch. Fl. 505 (1881), heissen, nicht *Sassafras officinale* Nees & Eberm. Handb. Med.-pharm. Bot. 2 : 418 (1831); *Schoenus pusillus* Sw. Nov. Gen. & Sp. Pl. 20 (1788), indessen, zu *Rynchospora* versetzt, wird nicht *Rynchospora pusilla* (Sw.) Griseb. Kar. 123 (1857), genannt, da vor dem Jahre 1857 dasselbe Binom für eine andere Art, *Rynchospora pusilla* Chapm. (1849), publiziert wurde.

(*c*) Eine zum Artenrange erhobene Unterart behält denselben Namen, wenn das resultierende Binom nicht schon vorher publiziert worden ist.

BEISPIELE. — *Sparganium simplex androcladum* Engelm. in A. Gray Man. Ed. 5, 481 (1867), wenn als gute Art angesehen, muss die Benennung *Sparganium androcladum* (Engelm.) Morong, Bull. Torrey Club, 15; 78 (1888), erhalten; *Juncus acuminatus robustus* Engelm. Trans. Acad. Sci. St. Louis, 2 : 463 (1868), indessen, wird nicht *Juncus robustus* (Engelm.) Coville in Britt. & Brown, Ill. Fl. 1 : 395 (1896), genannt, da vor dem Jahre 1896 dieses Binom für eine andere Art, *Juncus robustus* S. Wats. Proc. Am. Acad. 14 : 302 (1879), gebraucht wurde.

REGEL 10. Ein Gattungs- oder Untergattungsname gilt als publiziert wenn derselbe in Druckschriften verteilt worden ist (1) mit einer Gattungs- oder Artenbeschreibung (oder in der Paläobotanik mit einer Abbildung) und mit einem binären Artennamen; (2) mit einem Gattungs- und Artennamen und mit dem Citate einer schon früher publizierten Beschreibung; oder (3) mit Hinweis auf eine Artenbeschreibung, welche durch Citat mit einer schon früher mit binären Namen publizierten Art in Verbindung gebracht werden kann.

BEISPIELE. — *Pachysandra* Michx. Fl. Bor. Am. **2**: 177 (1803), ist mit einer Beschreibung der Gattung und Art und einem binomischen Artennamen publiziert; *Brasenia* Schreb. ex Gmel. Syst. **2**: 853 (1791), ist mit einer Beschreibung der Gattung und einen binomischen Artennamen publiziert; *Silphium* L. Sp. Pl. 919 (1753), ist mit einer Beschreibung der Art und einen binomischen Artennamen publiziert; *Poacites* Schloth. Petrefact. 416. *pl. 26, f. 1, 2* (1820), eine fossile Gattung, ist mit Abbildungen und einem binomischen Artennamen publiziert, aber ohne Beschreibung; *Nyssa* L. Sp. Pl. 1058 (1753), ist mit einem Gattungs- und Artennamen und dem Citate früheren veröffentlichten Beschreibungen publiziert; *Dryopteris* Adans. Fam. Pl. **2**: 20 (1763) ist publiziert mit Hinweis auf die Beschreibung einer Art welche durch Citat mit dem früher publizierten *Polypodium Filix-mas* L. Sp. Pl. 1090 (1753), in Verbindung gebracht werden kann, indem Adanson sowie Linné *Filix mas* von Fuchs citiren.

REGEL 11. Namen der Untertribus, Ordnungen und Zwischengruppen gelten als publiziert wenn dieselben in Druckschriften mit direkten oder indirekten Citaten einer Gattung der gleichen Gruppe verteilt worden sind.

BEISPIELE. — *Moraceae* Lindl. Veg. Kingd. 266 (1847), ist mit dem Citate der dazu gehörenden Gattungen publiziert; *Ophioglossales* Engler, Syll. Ed. 2, 63 (1898), ist mit dem Citate der dazu gehörenden Gattungen publiziert.

REGEL 12. Ein Name wird weder durch dessen Citation in der Synonymik noch durch zufälligen Gebrauch als gültig publiziert betrachtet.

BEISPIELE. — *Echeveria spicata*, von De Candolle citirt, Prodr. **3**: 349 (1828), als Synonym von *Fouquiera formosa*, ist nicht publiziert, und *Echeveria* DC., auf Seite 401 desselben Bandes publiziert, ist daher nicht ungültig; *Acrostichum Plumieri* "Desv. herb.," als Synonym von *A. viscosum* in Fée, Mém. Fam. Foug. **2**: 46 (1845), citirt, ist nicht publiziert, und *Acrostichum Plumieri* Fée, auf Seite 50 desselben Werkes als Art publiziert, ist daher nicht ungültig; *Hormisus opuntioides* Targ., citirt von Bertoloni, Amoen. Ital. 316 (1819), als Synonym von *Fucus Sertolara* Bertol. (= *Halimeda Tuna*), wird dadurch als nicht publiziert betrachtet.

REGEL 13. Von den gleichzeitig in demselben Werke publizierten Namen sind diejenigen welche Platzpriorität haben als prioritätsberechtigt anzuerkennen.

BEISPIELE. — *Alsine* L. Sp. Pl. 272, besitzt Prioritätsrecht über *Stellaria* L. Sp. Pl. 421; *Aira spicata* L. Sp. Pl. 63, besitzt Prioritätsrecht über *Aira spicata* L. Sp. Pl. 64; *Hibiscus Moscheutos* L. Sp. Pl. 693, besitzt Prioritätsrecht über *H. palustris*, da dieser Name auf derselben Seite zuerst erscheint.

Sektion IV. Anwendung der Namen.

REGEL 14. Der nomenklatorische Typus einer Art oder Unterart ist dasjenige Exemplar welches vom beschreibenden Autor in der ursprünglichen Publikation mit dem Namen belegt wurde.

BEISPIELE. — *Polypodium marginale* L. Sp. Pl. 1091, ist als Typus dargestellt durch die Bezeichnung eines Exemplars welches von Kalm in Canada gesammelt wurde; *Stachys arenicola* Britton, Man. 792 (1901), ist als Typus dargestellt durch die Bezeichnung eines Exemplars aus Staten Island, N. Y.; *Carex intumescens Fernaldii* Bailey, Bull. Torrey Club, **20**: 418 (1893), its als Typus dargestellt durch die Bezeichnung eines Exemplars welches in Cedar Swamp, Aroostook County, Maine, von M. L. Fernald gesammelt wurde.

(*a*) Wenn mehr als ein Exemplar ursprünglich citirt wurde, dann kann der Typus oder die diesen miteinschliessende Gruppe durch die Benennung nach den Sammler, der Lokalität, oder der Wirtpflanze angedeutet werden.

BEISPIELE. — *Eriogonum Porteri* Small, Bull. Torrey Club, **25**: 41 (1898), ist von mehreren Exemplaren beschrieben, von welchen das von T. C. Porter gesammelte den Typus vorstellt; *Gaillardia arizonica* A. Gray, Syn. Fl. N. Am. 1^2: 353 (1884), ist von mehreren Exemplaren beschrieben, von welchen das von Palmer in Arizona gesammelte den Typus vorstellt; *Cuscuta Cephalanthi* Engelm. Am. Jour. Sci. **43**: 336 (1842), ist auf verschiedene Wirtpflanzen Exemplare basirt, von welchen das auf *Cephalanthus* vorkommende den Typus vorstellt.

(*b*) Zwischen gleichwertigen Exemplaren gilt dasjenige als Typus welches mit der ursprünglichen Beschreibung zuerst abgebildet, oder im Falle dass die Abbildung fehlt, zuerst genannt wurde.

BEISPIELE. — *Calyptridium roseum* S. Wats. Bot. King's Exp. 44. *pl. 6, f. 6–8* (1871), ist auf wenigstens drei Exemplare basirt, von welchen dasjenige als Typus betrachtet wird welches abgebildet war; *Arnica cordifolia* Hook. Fl. Bor. Am. 1: 331 (1833), ist auf zwei Exemplare basirt, von welchen keine Abbildungen vorhanden waren, und das erstgenannte, von Drummond im Alpengehölz den Felsengebirgen gesammelt, gilt als Typus.

(*c*) Fehlt ein Originalexemplar dann dient dasjenige als Typus welches in erkennbarer Abbildung dargestellt ist oder (wenn keine Abbildung da ist) durch die zuerst citirte oder nachher veröffentlichte Beschreibung repräsentirt ist.

BEISPIELE. — *Trillium sessile* L. Sp. Pl. 340, ist auf drei Citate basirt, von welchen das zweite als Typus betrachtet wird, da es mit einer Abbildung repräsentirt ist; *Centaurea Scabiosa* L. Sp. Pl. 913, ist auf mehrere Citate basirt, von welchen das erste als Typus dient, da keine Abbildungen citirt sind.

REGEL 15. Der nomenklatorische Typus einer Gattung oder einer Untergattung ist diejenige Art welche ursprünglich vom Autor des Namens als Typus benannt oder bezeichnet wurde.

In Falle dass keine Art als Typus bezeichnet worden ist dann dient die erste in der Reihenfolge unter den folgenden Bedingungen dazu berechtigte binomische Art als Typus :

(*a*) Der Typus ist aus einer ursprünglich als typisch bezeichneten Untergattung, Sektion, oder Liste von Arten zu wählen.

BEISPIELE. — *Psilogramme* Kuhn, Festschr. 50-Jähr. Jub. Königs. Realschule zu Berlin, 332 (1882), ist als Typus dargestellt durch die erstgenannte Art der zweiten Sektion *Eupsilogramme*, und nicht durch Arten der ersten Sektion *Jamesonia*, welche auf einen früher publizierten Gattungsnamen basirt ist; *Phania* DC. Prodr. 5 : 114 (1826), ist als Typus dargestellt durch *P. multicaulis* DC., die einzige Art in der Sektion *Euphania*.

(*b*) Eine abgebildete Art ist einer nichtabgebildeten in derselben Publikation vorzuziehen, wenn aber zu der Zeit keine Abbildung vorhanden war dann erhält eine von einem Citate einer Abbildung begleitete Art den Vorzug.

BEISPIELE. — *Lespedeza* Michx. Fl. Bor. Am. 2 : 70 (1803), ist als Typus dargestellt durch *L. procumbens* Michx. *loc. cit. pl. 39*, die zuerst abgebildete Art; *Basanacantha* Hook. f. in Benth. & Hook. Gen. Pl. 2 : 82 (1873), ist als Typus dargestellt durch die zweitgenannte Art, *Randia tetracantha* (Cav.) DC., welche von Cavanilles abgebildet war, während *Randia Humboldtiana* DC., die von Hooker zuerst genannte Art, nicht abgebildet war.

(*c*) Die Typen der durch Citate nichtbinärer Literatur adoptirten Gattungen (mit oder ohne Namensänderung) sind von denjenigen der ursprünglichen Arten zu wählen die Namen in der ersten binären Publikation der Gattung erhielten. Die Typen der Gattungen von Linné's Species Plantarum (1753) sind durch die in seiner Genera Plantarum (1754) angegebenen Citate zu bestimmen.

ANMERKUNG. — Linné's Species Plantarum enthalten keine Hinweise auf Gattungen, aber die Ausgabe der Genera Plantarum des Jahres 1754 war offenbar zur selben Zeit in Bearbeitung und wirklich ein ergänzender Band desselben Werkes. Es stimmt mit der Behandlungsweise welche in Species Plantarum befolgt wird mehr überein als die anderen Ausgaben, und macht es daher möglich mehr Linneische Gattungsnamen in ihrer jetzigen Anwendung beizubehalten.

BEISPIELE. — *Cypripedium* L. Sp. Pl. 951, eine Gattung aus Tournefort adoptirt mit einer Veränderung seiner Benennung *Calceolus*, ist als Typus dargestellt durch *Cypripedium Calceolus*, die einzige Art welche von beiden Autoren gemeinschaftlich gebraucht wurde; *Seseli* L. Sp. Pl. 259, eine Gattung aus Boerhaave adoptirt, ist als Typus dargestellt durch die

zweite Linneische Art, *Seseli montanum*, welches in Linné die erste Art ist welche von beiden Autoren gemeinschaftlich gebraucht wurde; *Silene* L. Sp. Pl. 416, eine Gattung aus Dillenius adoptirt mit einer Veränderung seiner Benennung *Viscago*, ist als Typus dargestellt durch *Silene anglica*, die erste der dreizehn Arten von Dillenius abgebildet in Linné; *Fritillaria* L. Sp. Pl. 303, eine Gattung aus Tournefort adoptirt, ist als Typus dargestellt durch die fünfte Linneische Art, *Fritillaria Meleagris*, eine der drei Arten in *Fritillaria* eingeschlossen von beiden Autoren, und ist von den drei Arten gewählt worden da es diejenige ist welche Tournefort abbildete.

(*d*) Wird ein präbinärer Gattungsname durch die Publikation eines binären Gattungsnamens verdrängt, dann deutet die Anwendung dieses verdrängten Namens als Benennung einer unter dem neuen Gattungsnamen eingereihten Art den Typus an.

BEISPIEL.—*Dianthus* L. Sp. Pl. 409, eine aus Tournefort adoptirte Gattung mit einer Veränderung dessen Benennung *Caryophyllus*, ist durch *Dianthus Caryophyllus*, eine der 15 ursprünglichen Linneischen Arten, als Typus dargestellt.

(*e*) Wird ein ehemaliger Artenname einer miteingeschlossenen Art zum Namen der Gattung angewandt, dann deutet dieser den Typus an.

BEISPIELE.—*Amsonia* Walt. Fl. Car. 98 (1788), ist als Typus dargestellt durch *Tabernaemontana Amsonia* L., eine der zwei urpsrünglichen Arten; *Sordaria* Ces. & DeN. Comm. Soc. Critt. Ital. 1 : 225 (1863), ist als Typus dargestellt durch *Sphaeria Sordaria* Fr., eine der 12 ursprünglichen Arten.

(*f*) Um Veränderungen im gegenwärtigen Gebrauche eines Linneischen Gattungsnamens zu verhüten kann eine allgemein bekannte und wirtschaftlich wichtige Art, in Uebereinstimmung mit dem folgenden von Linné niedergelegten Grundsatze, als Typus gewählt werden: (Phil. Bot. 197. 1751) "Si genus receptum, secundum jus naturae et artis, in plura dirimi debet, tum nomen antea commune manebit vulgatissimae et officinali plantae."

BEISPIELE.—*Poa* L. Sp. Pl. 67, ist als Typus dargestellt durch *P. pratensis* L., die gewöhnlichste der ursprünglichen Arten; *Mollugo* L. Sp. Pl. 89, ist als Typus dargestellt durch *M. verticillata* L., die gewöhnlichste der ursprünglichen Arten.

Sektion V. Verwerfung der Namen.

REGEL 16. Ein Name wird verworfen wenn derselbe präoccupirt ist (Homonym).

(*a*) Ein Arten- oder Unterartenname ist Homonym wenn derselbe als Name einer anderen Art unter demselben Gattungsnamen schon publiziert worden ist. Zwei Unterarten derselben Gattung können denselben Namen nicht behalten.

BEISPIELE. — *Acer saccharinum* Wang. Amer. 36. *pl. 2, f. 26* (1787), ist als Homonym zu betrachten von *Acer saccharinum* L. Sp. Pl. 1055 (1753); *Vaccinium myrtilloides* Hook. Fl. Bor. Am. **2**: 32 (1834), ist ein Homonym von *Vaccinium myrtilloides* Michx. Fl. Bor. Am. **1**: 234 (1803), und ist verwerflich ob das letztere als bestimmte Art betrachtet wird oder nicht; *Juncus nodosus megacephalus* Torr. Fl. N. Y. **2**: 326 (1843), ist ein Homonym von *Juncus megacephalus* M. A. Curtis, Boston Jour. Nat. Hist. **1**: 132 (1835); *Chrysopsis pilosa* (Walt.) Britton, Mem. Torrey Club, **5**: 316 (1894), ist ein Homonym von *Chrysopsis pilosa* Nutt. Jour. Acad. Nat. Sci. Phila. **7**: 66 (1834), und ist verwerflich, obgleich *Erigeron pilosum* Walt. im Jahre 1788 publiziert war; *Carex scoparia moniliformis* Tuckerm. Enum. Meth. Car. 17 (1843), und *Carex straminea moniliformis* Tuckerm. *loc. cit.*, können nicht beide beibehalten werden.

(*b*) Ein Gattungs- oder Untergattungsname ist Homonym wenn derselbe schon vorher als Name einer anderen Gattung publiziert oder im Druck vorgeschlagen wurde.

BEISPIELE. — *Torreya* Arn. Ann. Nat. Hist. **1**. 130 (1838), ist ein Homonym von *Torreya* Raf. Am. Mo. Mag. **3**: 356 (1818), von *Torreya* Raf. Jour. Phys. **89**: 105 (1819), von *Torreya* Spreng. Neue Entdeck. **2**: 121 (1821), und von *Torreya* Eat. Man. Ed. 5, 420 (1829); *Rivularia* Ag. Syn. Alg. Scand. xxxviii (1817), ist ein Homonym von *Rivularia* Roth, Cat. **1**: 212 (1797); *Nesaea* Lamour. Nouv. Bull. Soc. Philom. **3**: 185 (1812), ist ein Homonym von *Nesaea* Commers. ex Juss. Gen. Pl. 332 (1789); *Bulliarda* DC. Bull. Soc. Philom. 3^{49}: 1 (1801), ist ein Homonym von *Bulliarda* Neck. Elem. **2**: 321 (1790).

(*c*) Aehnliche Namen werden als Homonyme behandelt nur wenn dieselben ungleiche Schreibweisen desselben Wortes vorstellen, oder im Falle von Arten- oder Unterartennamen wenn dieselben nur in den adjektivischen oder genitivischen Endungen verschieden sind.

BEISPIELE. — *Penicillus* und *Penicillium*, *Callitriche* und *Calothrix*, *Nemastylis* und *Nematostylis*, *Pterigophyllum* und *Pteridophyllum*, können beibehalten werden; *Cyathophora* und *Cyathophorum*, *Asterocarpus* und *Astrocarpus* können nicht beibehalten werden. *Greenei* und *Greenii*, nach verschiedenen Personen benannt, Greene und Green, können in derselben Gattung beibehalten werden; *virginicus*, *virginianus* und *virginiensis*, *oreganus* und *oregonensis*, *Hookeri* und *Hookerianus*, können nicht in derselben Gattung beibehalten werden.

REGEL 17. Ein Name wird verworfen wenn ein älterer gültiger auf ein anderes Bestandteil derselben Gruppe basirter Name (Metonym) vorhanden ist.

BEISPIELE. — *Meibomia* Heist. ex Adans. Fam. Pl. **2** : 509 (1763) ist auf *Hedysarum canadense* L. Sp. Pl. 748, basirt, und *Desmodium* Desv. Jour. de Bot. II. **1** : 122 (1813), ist als typus dargestellt durch *Hedysarum asperum* Poir. Encycl. Suppl. **6** : 408 (1804), folglich, wenn diese Arten als zur selben Gattung gehörend betrachtet werden, ist der Name *Desmodium* verwerflich; *Boletopsis* P. Henn. Nat. Pflanzenf. 1^{1**} : 194 (1899), kann nicht als eine Gattung anerkannt werden mit Einschluss einer Sektion den Namen *Boletinus* Kalchb. tragend, da diese in 1877 als eine Gattung eingesetzt wurde; *Sisymbrium altissimum* L. Sp. Pl. 659 (1753), *Sisymbrium Sinapistrum* Crantz, Stirp. Austr. Ed. 2, 52 (1769), und *Sisymbrium pannonicum* Jacq. Coll. **1** : 70 (1786), haben verschiedene Typen, aber wenn diese als zu derselben Art gehörend betrachtet werden, so sind die zwei späteren Namen Metonymen von den Linneischen.

REGEL 18. Ein Name wird verworfen wenn ein älterer gültiger auf denselben Typus basirter Name (Typonym) vorhanden ist.

BEISPIELE.—*Miegia* Pers. Syn. **1** : 101 (1805), ist ein Typonym von *Arundinaria* Michx. Fl. Bor. Am. **1** : 73 (1803), da beide auf dieselbe Art basirt sind; *Asplenium Vincentis* Christ, Bot. Jahrb. **24** : 109 (1897), ist ein Typonym von *A. Guildingii* Jenm. Gard. Chron. III. **15** : 70 (1894), da beide basirt sind auf H. H. Smith's *No. 1346* aus St. Vincent.

REGEL 19. Ein Name wird verworfen so lange die natürliche Gruppe zu deren Benennung der Name dient unbestimmt ist (Hyponym).

(*a*) Ein Arten- oder Unterartenname ist Hyponym wenn derselbe nicht in Verbindung mit einer durch diagnostische Merkmale oder durch Hinweis auf ein Typus-Exemplar, eine Abbildung oder eine Lokalität identifizierbare Beschreibung gebraucht worden ist.

BEISPIELE.—*Gentiana hybrida* Raf. Med. Rep. II. **5** : 353 (1808), ist ein Hyponym, da keine Diagnose publiziert ist; *Lechea furfuracea* Raf. New Fl. Am. **1** : 92 (1836), ist ein Hyponym, da die Beschreibung nicht identifizierbar ist.

(*b*) Ein Gattungs- oder Untergattungsname ist Hyponym wenn derselbe durch spezifisches Citat mit einer vorher oder gleichzeitig publizierten binomischen Art nicht associierbar ist; oder wenn die Typus-Art noch nicht identifiziert ist.

BEISPIELE.—*Adodendrum* Necker, Elem. **1** : 214 (1790), und *Calesiam* Adans. Fam. Pl. **2** : 446 (1763), sind Hyponyme, da ihre Autoren keine binomische Art oder eine Art welche vorher einen Binom erhalten hatte, citirten; *Nudilus* Raf. Atl. Jour. 176 (1833), ist ein Hyponym, da die Typus-Art, *N. paradoxus*, noch nicht identifiziert ist.

TEIL III. RECHTSCHREIBUNG UND CITATION.

Sektion I. Rechtschreibung.

1. Die ursprüngliche Schreibweise ist mit Ausnahme der folgenden Fälle beizubehalten. Die Aenderungen bleiben ohne Einfluss auf Priorität.

   (*a*) Offenbar typographische Fehler können corrigirt werden.

   BEISPIELE.— *Scoria* Raf. ist ein Druckfehler, für *Hicoria*; *Rumhora* Raddi, ist ein Druckfehler für *Rumohra*, nach K. von Rumohr genannt.

   (*b*) Adjektivische Arten- und Unterartennamen stimmen im Geschlechte mit dem associierten Gattungsnamen überein.

   BEISPIELE.— *Polygonum articulatum* L. = *Polygonella articulata* (L.) Meissn.; *Sisymbrium amphibium palustre* L. = *Roripa palustris* (L.) Bess.

   (*c*) Nach Personen gebildete Gattungsnamen sind Feminina und sind, wenn urspünglich in anderen Formen, zu ändern.

   BEISPIELE.— *Lippius* S. F. Gray, *Kantius* S. F. Gray, *Pallavicinius* S. F. Gray, sollen verändert werden zu *Lippia*, *Kantia*, und *Pallavicinia*, und doch datiren von 1821, dem Jahre in welchem sie ursprünglich publiziert sind.

   (*d*) Die Schreibweise von Namen in Werken vorgeschlagen in welchen v und j als Vokale und u und i als Konsonante vorkommen ist zu modernisieren.

   BEISPIELE. — *Euonymus*, nicht *Evonymus*; *Naias*, nicht *Najas*; *Neuropteris*, nicht *Nevropteris*; *Rivularia*, nicht *Riuularia* (*Rivvlaria*); *Jungia*, nicht *Iungia*.

2. Gattungsnamen werden mit grossen Anfangsbuchstaben geschrieben.

   BEISPIELE.— *Desfontainea*, nicht *des Fontainea*; *Durvillaea*, nicht *d' Urvillaea*.

3. Artennamen werden nur dann mit grossen Anfangsbuchstaben geschrieben wenn dieselben Substantive oder von Personennamen abgeleitete Adjektive sind.

   BEISPIELE. — *Asplenium Trichomanes* L.; *Uromyces Trifolii* (Hedw.) Lév.; *Trichomanes Smithii* Hook.; *Galium Boryanum* Walp.

4. Die Publikation zweisprachiger Namen ist zu vermeiden, aber publizierte Namen sind aus diesem Grunde nicht zu verwerfen.

   BEISPIELE. — *Liquidambar* ist Lateinisch-Arabisch; *Fimbristylis* ist Lateinisch-Griechisch; *Actiniceps* ist Griechisch-Lateinisch.

5. Die Namen der Hybriden sind wie folgt zu schreiben:

(*a*) Ein Bastard wird durch die Namen der elterlichen Art oder Unterart in alphabetischer Ordnung und mit dem Zeichen × verbunden bezeichnet; aber in experimentalisch produzirten Bastarden, oder wenn das Geschlecht der Eltern bekannt ist, wird der Name der Mutter zuerst geschrieben und das Geschlecht durch die Zeichen ♀, ♂, gekennzeichnet.

BEISPIELE. — *Carex debilis* × *virescens*; *Digitalis lutea* ♀ × *purpurea* ♂.

(*b*) Wenn wünschenswert kann ein Bastard wie eine Art oder Unterart benannt werden, vorausgesetzt dass die Hybridität durch die Anbringung eines × vor dem Binom oder Trinom ausgedrückt wird.

BEISPIEL. — × *Salix capreola* Kern.

(*c*) Ein Bastard zweier Arten verschiedener Gattungen kann durch die Hinzufügung des Artennamens zum Gattungsnamen der Mutter, oder wenn das Geschlecht der Eltern unbekannt, zum nach alphabetischer Ordnung erststehenden Gattungsnamen bezogen werden.

BEISPIEL. — × *Ammophila baltica* Link = *Ammophila arenaria* × *Calamagrostis Epigeios*.

(*d*) Ein Bastard mit einer oder auch beiden der Elternpflanzen von hybridischer Abstammung kann durch die Anführung des Namens der hybridischer Elternpflanze in runde Klammern gesetzt werden.

BEISPIEL. — *Salix* (*aurita* × *repens*) × *cinerea*.

(*e*) Die grössere Bedeutung der einen Elternpflanze der anderen gegenüber kann durch die Zeichen >, < ausgedrückt werden.

BEISPIELE. — *Mentha longifolia* > × *rotundifolia*; *Mentha longifolia* × < *rotundifolia*.

Sektion II. Autorcitation.

1. Eine nach dem Namen stehende Autorcitation bezieht sich auf den Autor der den Namen zuerst publizierte; der Name des Autors kann abgekürzt werden, aber nie in solcher Weise dass Zweideutigkeit dadurch entsteht.

BEISPIELE. — Spreng. für Sprengel, nicht Spr., zum Unterscheiden von

Spruce und anderen; Michx. für Michaux, nicht Mich., zum Unterscheiden von Micheli; S. Wats. für Sereno Watson, zum Unterscheiden von H. C. Watson.

2. In den folgenden Fällen ist der Name des ursprünglichen Autors in runde Klammern zusetzen, und der Name des Autors der die Benennung in ihrer acceptirten Form und Anwendung zuerst publizierte ist demselben nachzusetzen.

(*a*) Ein Artenname ursprünglich mit einem anderen Gattungsnamen oder ein Unterartenname ursprünglich mit einem anderen Binom verbunden.

BEISPIELE. — *Moneses uniflora* (L.) A. Gray, für die Pflanze ursprünglich von Linné beschrieben als *Pyrola uniflora*, und nachher zuerst publiziert als *Moneses uniflora* von Asa Gray; *Chondrophora nauseosa glabrata* (A. Gray) Rydberg für *Bigelovia graveolens* var. *glabrata* A. Gray.

(*b*) Ein Gattungsname adoptirt durch Citate aus Werken die vor der ersten Ausgabe von Linné's Species Plantarum (1753) erschienen sind.

BEISPIELE. — *Linnaea* (Gronov.) L.; *Anthoceros* (Mich.) L.; *Valerianella* (Tourn.) Poll.

(*c*) Ein Name der für eine Kategorie angewandt wird aber ursprünglich für eine andere vorgeschlagen wurde.

BEISPIELE. — *Salix cordata angustata* (Pursh) Anders., ursprünglich *Salix angustata* Pursh; *Actaea rubra* (Ait.) Willd., ursprünglich *Actaea spicata* var. *rubra* Ait.; *Ardisia* Unterg. *Pickeringia* (Nutt.) Mez, ursprünglich die Gattung *Pickeringia* Nutt; *Raphidostegium* (Br. & Sch.) De Not., ursprünglich *Rhynchostegium* Unterg. *Raphidostegium* Br. & Sch.

3. Ein Komma zwischen dem Namen der Pflanze und dem des Autors ist nicht wünschenswert.

BEISPIELE. — *Rumex* L., nicht *Rumex*, L.; *Phacelia congesta* Hook., nicht *Phacelia congesta*, Hook.; *Ilysanthes dubia* (L.) Barnhart, nicht *Ilysanthes dubia*, (L.), Barnhart.

The effect of chemical irritation on the respiration of fungi

ADA WATTERSON

The effect of chemical irritation upon the growth of fungi has been the subject of considerable study for a number of years past. The results obtained by Raulin, * Richards, † Ono, ‡ Hattori, § and others have gone to prove that certain metallic salts, in small quantities, stimulate the metabolic activity of various fungi and thereby induce a more rapid growth than is normal. This action is interpreted by Richards ‖ as being a means by which the plant is enabled to dispose more economically of the sugar or other source of the carbohydrates required in growth.

The fungi used by Richards in his experiments were *Sterigmatocystis* (*Aspergillus*) *niger*, *Penicillium glaucum*, and *Botrytis*, and the substances which served as irritants were zinc, iron, cobalt and nickel sulphates, NaFl, LiCl, Na_2SiO_3, cocaine, morphine and amygdalin. Ono made use of the same irritants with the addition of $HgCl_2$. Hattori experimented with $CuSO_4$; Yasuda¶ with certain alkaloids; Hueppe** found the activities of bacteria stimulated by certain poisons. Schultz †† likewise observed an acceleration of fermentation in yeast following the addition of small quantities of poisonous substances, but whether this was due to a more

* Raulin, J. Études chimiques sur la végétation; deuxiéme partie. Ann. Sci. Nat. Bot. V. **11**: 190–299. 1869.

† Richards, H. M. Die Beeinflussung des Wachsthums einiger Pilze durch chemische Reize. Jahrb. Wiss. Bot. **30**: 665–688. 1897.

‡ Ono, N. Ueber die Wachsthumsbeschleunigung einiger Algen und Pilze durch chemische Reize. Jour. Coll. Sci. Imp. Univ. Tokyo, **13**: 141–186. 1900.

§ Hattori, H. Studien über die Einwirkung des Kupfersulfats auf einige Pflanzen. Jour. Coll. Sci. Imp. Univ. Tokyo, **15**: 371–394. 1901.

‖ Richards, H. M. The effect of chemical irritation on the economic coefficient of sugar. Bull. Torrey Club, **26**: 463–479. 1899.

¶ Yasuda, A. On the effect of alkaloids upon some moulds. Bot. Mag. Tokyo, **15**: 79–83. 1901.

** Hueppe, F. Naturwissenschaftliche Einführung in die Bakteriologie, 55. Wiesbaden, 1896. (Not seen.)

†† Schultz, H. Pflüger's Archiv, **42**: —. 1888. (Reference in Bot. Zeitung, **46**: 610. 1888.)

rapid growth and division, or to greater activity of the individual cells, has not been determined.

Experiments were likewise performed by Ono on algae with like results except that the optimum concentration of the stimulants was much smaller. Similar work has been done on the phanerogams by Copeland and Kahlenberg * using pure metals as stimulants, by Townsend † with ether and HCl, and by Kahlenberg and True.‡ Chapin § also found an increase in the growth of certain seedlings due to the presence in the atmosphere of small amounts of CO_2, larger quantities of which acted as a poison.

In all of these cases the amount of stimulation is indicated by the increase in the plant body, as shown by dry weight in the case of the fungi and algae, and by the increased surface of the organs of phanerogams. It is well known, however, ‖ that only a part of the nutrient material absorbed by the plant is used to build up its living substance; a part is continually being oxidized to provide the necessary energy for carrying on life-processes. Fully to determine, therefore, the relation between the plant and its food-supply, one would have to take into account both the amount of the latter which is used as constructive material, measured by the increased weight or size of the plant, and that which undergoes katabolic changes during which CO_2 and other waste products are liberated.

Richards' experiments were concerned with the first factor, that is, the amount of dry substance produced and its relation to the amount of sugar used, or the economic coefficient. Ono confirmed his results, and in addition he determined the relative quantities of oxalic acid produced by fungi under normal conditions and under stimulation, finding a decrease in the latter case with all substances tried except $NiSO_4$. To account for this Ono suggests

* Copeland, E. B., and Kahlenberg, L. The influence of the presence of pure metals upon plants. Trans. Wisc. Acad. **12**: 454–474. 1899.

† Townsend, C. O. The correlation of growth under the influence of injuries. Ann. Bot. **11**: 509–532. 1897. — The effect of hydrocyanic acid gas upon grains and other seeds. Bot. Gaz. **31**: 241–264. 1901.

‡ Kahlenberg, L., and True, R. H. On the toxic action of dissolved salts and their electrolytic dissociation. Bot. Gaz. **22**: 81–124. 1896.

§ Chapin, P. Einfluss der Kohlensäure auf das Wachsthum. Flora, **91**: 348–379. 1902.

‖ Pfeffer, W. Physiology of plants, ed. 2, **1**: 287, 523. 1900.

that the carbohydrate which during normal growth is decomposed, in the processes of metabolism, to form oxalic acid, is not so transformed during the accelerated growth resulting from stimulation, but is immediately changed into constructive material for the plant body. Of this, the decrease in the economic coefficient (*i. e.*, ratio of dry weight to sugar used) of the stimulated cultures seems an indication. Oxalic acid is not, however, the only waste product of metabolism. Since, according to Pfeffer,* "a decreased formation of oxalic or other organic acids is accompanied by an increase in the ratio of CO_2 exhaled to the oxygen absorbed," the amount of CO_2 given off under the varying conditions must also be reckoned with; it must be determined, that is, whether all the additional carbohydrate normally used to produce oxalic acid is now transformed into formative substance, or whether part of it may be wholly oxidized to produce larger quantities of CO_2. This ratio of the dry substance produced to the amount of CO_2 exhaled, or the respiratory quotient, was found by Kunstmann † to vary with changing conditions, decreasing with a rise of temperature or with higher concentrations of the nutrient solution. The effect of chemical stimulation was not included among the conditions.

The effect of such stimulation upon respiration alone without regard to the possible acceleration of growth ensuing was studied by Jacobi,† who obtained an increase in amount of CO_2 produced by certain phanerogams, due to the influence of KCl, NaCl, KNO_3, iodine, chinin, antipyrin, oxalic acid and various organic substances. Copeland ‡ obtained similar results; and likewise Kosinski § in the case of fungi. Morkowin ‖ found a decided

* Pfeffer, W. Physiology of plants, ed. 2, 1: 527. 1900.

† Kunstmann, H. Ueber das Verhältnis zwischen Pilzernte und verbrauchter Nahrung. Leipzig. 1895. [Inaug. Diss.]

‡ Jacobi, B. Ueber den Einfluss verschiedener Substanzen auf die Athmung und Assimilation submerser Pflanzen. Flora, 86: 289–327. 1899.

§ Copeland, Bot. Gaz. 35: 81–98, 160–183. 1903.

‖ Kosinski, I. Die Athmung bei Hungerzuständen und unter Einwirkung von mechanischen und chemischen Reizmitteln bei *Aspergillus niger*. Jahrb. Wiss. Bot. 37: 137–204. 1901.

¶ Morkowin, N. Recherches sur l'influence des anesthésiques sur la respiration des plantes. Revue Gén. de Bot. 11: 289–303, 341–352. 1899. — Ueber den Einfluss der Reizwirkunzen auf die intramoleculare Athmung der Pflanzen. Ber. Deut. Bot. Ges. 21: 72. 1903.

increase in the intensity of respiration, both normal and intramolecular, of etiolated leaves and shoots under the influence of ether, alcohol and various alkaloids. Pfeffer states * that according to Elfving and Lauren adult parts of higher plants, where stimulation is unaccompanied by growth, react in the same manner to a short treatment with ether and chloroform; he notes however that Detmer and also Bonnier and Mangin found no such reaction.

Summarizing then, the results quoted, we find that small quantities of certain poisonous substances act as stimulants, increasing the growth of certain plants; they also increase respiration, but what relation the latter increase bears to the former is not determined. Since, however, in the case of fungi, it has been found that stimulation raises the economic coefficient of the sugar, *i. e.*, allows the plant to make use of the sugar to form a greater amount of dry substance in a given time, the question of the amount of CO_2 which is produced at the same time becomes one of interest.

This problem was suggested to me by Dr. H. M. Richards, to whom I wish to express my gratitude for his interest and valuable assistanee. The work was done in the botanical laboratory of Barnard College during the winters of 1901–1902 and 1902–1903.

Two kinds of apparatus have been employed in carrying on this work, one that of Godlewski described by Kunstmann † the other a modification of the Pfeffer-Pettenkofer apparatus. In all the experiments, however, the fungi used were *Sterigmatocystis nigra* and *Penicillium glaucum*. The formula for the nutrient solution was that given by Richards: ‡

KH_2PO_4	0.05g.
$MgSO_4$	0.25g.
NH_4NO_3	1.00g.
$FeSO_4$	trace.
Sugar	5.00g.
Water	100 cm.

Only the purest chemicals and sugar obtainable were used,

* Pfeffer, W. Physiology of plants, Ed. 2, 1: 564. 1900.

† Kunstmann, *l. c.* 10. 1895.

‡ Richards. Jahrb. Wiss. Bot. **30**: 667. 1897.

and the water was twice distilled. The dishes and flasks in which the cultures were grown were rinsed with dilute HCl, carefully washed with double-distilled water and dried in a dry sterilizer. The spores were sown by rubbing small pieces of glass rod, exactly equal in size, upon the dry stock supply, and then transferring them to the dishes by means of glass tipped forceps. It was found convenient to keep a supply of the concentrated nutrient solution on hand, containing all the ingredients except sugar. The necessary amount was diluted and the sugar added when the series was set up.

At first the Godlewski apparatus used by Kunstmann was employed. This consisted, in brief, of a bell-jar enclosing two crystallizing dishes; the smaller of these held the fungus growing on 75 c.c. of the nutrient solution, and rested upon a glass strip placed across the larger dish which contained 150 c.c. of a 10 per cent. solution of KOH. The mouth of the jar was closed with a rubber cork provided with two holes through one of which passed a thermometer, and through the other a glass tube leading to a mercury valve, with which, in turn, was connected a KOH tube in such a way that air could pass into the jar, but could not escape from it. The bell-jar was sealed to a ground glass plate by means of vaseline and the joining was then painted with two coats of shellac to make it water tight. Three jars were used, one to serve as a control, and two for the experiment; the results given are, unless otherwise stated, the average of the two grown at the same time and under the same conditions. The greatest difficulty was experienced in keeping the cultures at an even temperature, approximately near the optimum for *Sterigmatocystis*, which is 30–34° C. The plan finally followed was to place all three jars in a zinc trough partly filled with water, the temperature of which would change more slowly than that of the air, and then to enclose the whole in a wooden box placed near a steam radiator. Under these conditions the temperature was raised to the neighborhood of 30° C., and varied not more than three or four degrees during any one experiment.

At the close of the experiment the fungus was killed with formalin as soon as the jar was opened, washed with distilled water, collected in weighed filter papers, dried in an oven at a

temperature of 70° C., and after cooling in a dessicator was carefully weighed. The KOH was diluted to 250 c.c.; the CO_2 was precipitated out of it by an equal quantity of barium hydrate, and the alkalinity of the remaining KOH was determined by titrating in the usual way with HCl of such strength that 1 c.c. of the acid = 1 mg. of CO_2. The result was then subtracted from that obtained by treating a certain amount of the stock KOH in the same way, and thus the amount of CO_2 given off by the fungus was obtained. The results are given in milligrams both for the weight of the fungus and the amount of CO_2 given off.

At the same time a series of experiments was carried on with a form of the Pfeffer-Pettenkofer respiration apparatus. The particular object in using this was to determine the rate of respiration during short intervals of time. Certain practical difficulties made this impossible, however, at that time, and the attempt was abandoned. Later, the same apparatus was started again in a slightly different way; *i. e.*, a strong solution of KOH was used and the same experiment was continued for a week at a time. It was set up in the dark room, which, being small and kept carefully closed, could be maintained at a comparatively even temperature in the neighborhood of 24° C.

The air in entering the apparatus passed through three U-tubes filled with pumice stone wet with a strong solution of KOH which was frequently renewed. A $Ba(OH)_2$ test-bottle was placed in the course to prove that no CO_2 passed over to the cultures, and the air was then distributed to these, four in number, by means of a T-tube and two Y-tubes. The cultures were grown in Erbenmeyer flasks of about 250 c.c. capacity, in which only 75 c.c. of the nutrient solution was used. This brought the film of mycelium at the level of the widest diameter of the flask and the flasks were all as nearly as possible of the same diameter. Between the culture flasks and the Pettenkofer tubes were interposed large test-tubes to prevent any possible backward flow of the KOH into the culture flasks; 150 c.c. of a 10 per cent. solution of KOH was introduced into the absorption tubes by means of a large pipette; the stock solution was kept in a tightly stoppered bottle sealed with vaseline. At the exit end of the tubes were placed screw pinch-cocks to regulate the amount of air drawn through

the apparatus, which was measured by the size and rate of flow of the bubbles of air in the tubes. Any slight difference in the rate of flow would be of no importance when the length of time during which the experiment ran — six to nine days — is taken into consideration. Between the tubes and the aspirator were inserted $Ba(OH)_2$ test-bottles. The aspirator was a simple one fastened to the water faucet.

At the close of the experiment the aspirator was shut off, the stop-cocks closed, the cultures immediately killed with formalin, and the contents of the tubes quickly emptied into bottles which were tightly corked. The amount of CO_2 absorbed was obtained by titration as before.

The metallic salts used as irritants in these experiments were $ZnSO_4$, $FeSO_4$ and LiCl. In each case such a concentration was used as had been found by Richards to be most favorable for an increased growth of the fungus. A 1 per cent. stock solution of anhydrous $ZnSO_4$ was made carefully; of this, .3 c.c. was used for 75 c.c. of the nutrient solution, giving thus a .004 per cent. solution or, expressed in terms of a normal (gram equivalent) solution,* .00049; of the $FeSO_4$, a .082 per cent. solution was used, or .01078 normal; and of LiCl, a .162 per cent. solution or .03822 normal.

In the following tables the results of the experiments are presented. In the first are given five series carried on with the Kunstmann apparatus, for three or four days at a temperature of 28°–31° C. The irritant was $ZnSO_4$. In the first column are given the dry weights of the cultures, both normal and irritated; in the second the amount of CO_2 given off by each, expressed in millegrams; and in the third the ratio of the weight to the CO_2. On examination of these figures it is evident that the addition of the zinc has caused an increase in the growth of the fungus and there has been likewise an increase in the amount of CO_2 respired. The amount of CO_2 respired is sometimes less than the corresponding weight of the culture, sometimes more, but when one compares the ratios of the two cultures in any one series, one finds very little difference between them; that is, the increase in respiration has been correspondingly great in both, with perhaps

* Livingston, B. E. The role of diffusion and osmotic pressure in plants, 22. 1903.

a slight advantage on the side of the irritated fungus. There is one exception to this, the fourth series, where the difference is unaccountably great, owing to an unusually large evolution of CO_2 from the stimulated culture. The increase in the amount of CO_2 given off is therefore but little greater than might naturally be expected from the increased respiratory surface due to the greater growth of the fungus.

The second table shows the results of five experiments performed with the Pettenkofer apparatus; the cultures, being grown at a lower temperature, 20–24° C., were allowed to run for a longer time: five, six, or seven days. In these, the figures for the irritated fungus represent the average of three cultures, grown under precisely similar conditions. Here too the ratios are very near one another. It is noticeable however that the difference, such as it is, is reversed in the second table, in all but one case, and the respiration of the normal grown in the Pettenkofer apparatus is therefore apparently a little greater, relatively, than that of the irritated fungus. The cause of this reversal of the ratios obtained by the two methods I have not been able to determine, but the difference is too slight to be of any importance. In Tables IX and X are given the same figures as in I and II, but the averages are found for the weights, CO_2, and ratios of each set of series; that is, for the series obtained by the Kunstmann method (Table IX), the average ratio of weight to CO_2 for the normal is .98, for the stimulated culture is 1.18; for those in the Pettenkofer apparatus (Table X) the average is 1.16 for the control as against .94 for the stimulated fungus.

Bearing these figures in mind, let us refer again to Ono's experiments in determining the amount of oxalic acid produced by fungi during growth under stimulation. With all the irritants used, with the exception of $NiSO_4$, he found a more or less marked decrease in the production of oxalic acid, a decrease shown (to quote some of his figures) * by the difference between 2.58 acid for every gram of dry weight of the normal, and 0.428 for the culture to which has been added .003 per cent $ZnSO_4$. The duration of this experiment was twenty-seven days and the temperature 16–20° C. Ono suggests three possible explanations for this de-

* Ono, *l. c.* 174. 1900.

crease:* (1) Although oxalic acid is a normal product of metabolism of the fungus, it is to be regarded nevertheless as a product of incomplete oxidation, and if the metabolic activity were increased, more CO_2 might be produced and therefore less oxalic acid. (2) The same result would occur in case the acid should disappear through a further "working-over" on the part of the fungus. Thereby it could be taken up again as building material or be decomposed without being useful to the fungus. Yet, as shown by Wehmer,† oxalic acid is poor food stuff for *Aspergillus*, and in the presence of a plentiful supply of sugar would probably remain intact. (3) Those materials (carbohydrates, etc.) which in normal growth are, by metabolism, transformed in part into oxalic acid, in consequence of increase in growth due to the stimulation are not separated out in that form, but are changed directly into the fungus body, in short, are applied as formative material.

Of these three possibilities, Ono concludes from his experiments that the third is the true explanation, since in every case the economic coefficient was much greater in the control than in the stimulated fungus. "Dieses Verhältnis deutet also an, das die Pilze bei Anvesenheit von Zinksulfat veranlasst wurden, mit einem verhältnismässig kleinen Verbrauch von Zucker eine bedeutend grössere körpersubstanz aufbauen zu können." ‡ This was also the conclusion reached previously by Richards. §

Further support is now given to this explanation by the results presented here, since Ono's first suggestion is thereby eliminated; that is, the present figures show that an amount of CO_2 is produced by the stimulated fungus which varies a little, being either more or less relatively to the weight of the fungus than that produced by the normal, but still remains comparatively close to the latter. The increase in metabolic activity has, therefore, not increased (relatively) the production of CO_2 although the formation of oxalic acid under similar conditions was materially checked, and the carbohydrates formerly used in the manufacture of the latter must consequently be devoted to the building up of new substance in the plant.

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* *Idem*, 157. 1900.

† Wehmer, Bot. Zeitung, **49**: 553. 1891.

‡ Ono, *l. c.* 160. 1900.

§ Richards, H. M. The effect of chemical irritation on the economic coefficient of sugar. Bull. Torrey Club. **26**: 463–479. 1899.

In Table III two series are shown, in which glycerine was used instead of sugar as the source of the carbohydrate. All of the figures here are rather low, owing to the slower growth of *Sterigmatocystis* in such a nutrient medium; the ratios, however, bear much the same relation to one another as in the preceding series, .61 and .69 (normal) to .77 and .68 (stimulated), respectively.

In the experiments recorded in Table IV, .082 per cent. (.01078 normal) $FeSO_4$ was used as the stimulant, since this concentration is near that which caused the greatest increase in growth in Richards' experiments. A .162 per cent. (.0381 normal) solution of LiCl was also tried (Tables V and VI), and although the increase in growth was not as great as might have been expected from Richards' results, yet the evolution of CO_2 bears much the same relation to it as in the preceding cases.

A few experiments were likewise made with *Penicillium glaucum*. Though *Penicillium* grows well at a lower temperature than does *Sterigmatocystis*, yet it grows slowly, and the total weight of the normal is seldom as great as is that of *Sterigmatocystis* in the majority of cases. The evolution of CO_2 is nevertheless very active, and the number of milligrams of CO_2 given off exceeds that of the dry weight of the fungus. Several of these cultures were raised on the usual nutrient medium (Table VII), and one (Table VIII) on a solution in which .5 gr. asparagin replaced the NH_4NO_3 as the source of nitrogen. The weight of the irritated fungus in the latter case was much greater than that of the normal, but the evolution of CO_2 kept pace with it to such an extent that the ratio is 1.22 as compared with 1.26 in the normal.

In reviewing, then, the results recorded here, it is evident that the addition of small quantities of $ZnSO_4$, $FeSO_4$ and LiCl has increased the rate of growth of *Sterigmatocystis* and *Penicillium* so that a larger amount of dry substance is produced within a given time than in normal cultures; that at the same time there has been an increase in the production of CO_2, an increase not too great, however, to be accounted for by the enlarged area of the plant. The ratio of dry weight to CO_2 of the irritated fungus is therefore approximately equal to that of the normal. Taking into account previous results which show that the effect of the addition of such poisons is to enable the plant to make more econom-

ical use of the carbohydrates supplied to it, we can interpret this action as a stimulus which causes the fungus to transform more of the food material into its own substance, and less into waste products such as oxalic acid, while at the same time the respiration remains relatively unchanged.

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TABLE I.

Kunstmann apparatus.

Sterigmatocystis nigra. 5 per cent. sugar solution.

A = Normal. B = average of two cultures to which .004 per cent.* or .00049 normal (gram equivalent) $ZnSO_4$ has been added. Temperature 28–30°C.

		Weight of Fungus.	CO_2	Ratio.	Time.
I.	A	335.2	155	.46	3 days.
	B	597.6	392.5	.67	
II.	A	398.5	455	1.13	3 "
	B	607.1	755	1.27	
III.	A	479.7	705	1.46	4 "
	B	805.1	1185	1 47	
IV.	A	480.8	415	.86	4 "
	B	783.7	1230	1.56	
V.	A	533.6	465	.87	4 "
	B	875.6	780	.89	

TABLE II.

Pettenkofer apparatus.

Same as in Table I, except that B = average of *three* cultures to which .004 per cent.,* (.00049 normal) $ZnSO_4$ has been added. Temperature 20–24° C.

		Weight of Fungus.	CO_2	Ratio.	Time.
VI.	A	600	420	.70	7 days
	B	1138.1	987	.86	
VII.	A	673.6	768	1.14	7 "
	B	888.0	888	1.00	
VIII.	A	885.5	1173	1.32	7 "
	B	1086.6	1143	1.05	
IX.	A	1056.0	978	.92	6 "
	B	1237.2	1036	.83	
X.	A	715	936	1.30	5 "
	B	1327	1263	.95	

* Calculated as anhydrous salt.

TABLE III.

Pettenkofer apparatus.

Nutrient solution a 5 per cent. glycerine instead of sugar; otherwise as in Table II. B = .004 per cent.* (.00049 normal) $ZnSO_4$.

		Weight.	CO_2	Ratio.	Time.	Temp.
XI.	A	489	300	.61	7 days.	23–25°
	B	1194.7	920	.77		
XII.	A	358.5	249	.69	7 "	20–24°
	B	724.3	498	.68		

TABLE IV.

Pettenkofer apparatus.

Same as in Table II, but B = .082 per cent.* (.01078 normal) $FeSO_4$.

		Weight.	CO_2	Ratio.	Time.	Temp.
XIII.	A	1142.5	867	.75	6 days.	26–29°
	B	1691	1513	.89		
XIV.	A	687	180	.26	6 "	
	B	1449.4	830	.57		

TABLE V.

Kunstmann apparatus.

Same as in Table I, but B = .162 per cent.* (.0381 normal) LiCl.

B here was not an average of two, but a single culture. Temperature 19–28° C.

		Weight of Fungus.	CO_2	Ratio.	Time.
XV.	A	615.5	514	.83	11 days
	B	775.5	814	1.04	

TABLE VI.

Pettenkofer apparatus.

Same as in Table II, but B = .162 per cent.* (.0381 normal) LiCl.

		Wght. Fungus.	CO_2	Ratio.	Time	Temp.
XVI.	A	1434	1110	.78	7 days	25°C.
	B	1501.1	1311	.87		
XVII.	A	679	645	.94	8 "	22°–27°C.
	B	723.7	747	1.03		

*Calculated as anhydrous salt.

TABLE VII.

Pettenkofer apparatus.

Penicillium glaucum. Otherwise as in Table II. B = .004 per cent.* (.00049 normal) $ZnSO_4$.

		Wght. Fungus.	CO_2	Ratio.	Time.	Temp.
XVIII.	A	489.50	705	1.43	7 days	18–22°C.
	B	525.75	739.5	1.40		
XIX.	A	438.5	729	1.66	9 "	19–22°C.
	B	539.33	991	1.66		

TABLE VIII.

Pettenkofer apparatus.

Penicillium glaucum.

Same as in Table VII., but .5 grams asparagin used in place of NH_4NO_3. B = .004 per cent.* (.00049 normal) $ZnSO_4$.

		Weight.	CO_2	Ratio.	Time.	Temp.
XX.	A	354.5	450	1.26	9 days.	17.5–20°
	B	932.16	1145	1.22		

TABLE IX.

Kunstmann apparatus. Average of five series shown in Table I. .004 per cent.* (.00049 normal) $ZnSO_4$.

	Normal.			Average of 2.		
	Weight.	CO_2	Ratio.	Weight.	CO_2	Ratio.
I.	335.2	155	.46	597.6	392.5	.67
II.	398.5	455	1.13	607.1	755	1.27
III.	479.7	705	1.46	805.1	1185	1.47
IV.	480.8	415	.86	783.7	1230	1.56
V.	533.6	465	.87	875.6	780	.89
Average.	445.56	439	.98	733.8	868.5	1.18

TABLE X.

Pettenkofer apparatus. Average of five series shown in Table II .004 per cent.* (.00049 normal) $ZnSO_4$.

	Normal.			Average of 3.		
	Weight.	CO_2	Ratio.	Weight.	CO_2	Ratio.
VI.	600	420	.70	1138.1	987	.86
VII.	673.6	768	1.14	888.0	888	1.00
VIII.	885.5	1173	1.32	1086.6	1143	1.05
IX.	1056.0	978	.92	1237.2	1036	.83
X.	715	936	1.30	1327.0	1263	.95
Average.	759.4	885.37	1.16	1207.23	1138.2	.94

* Calculated as anhydrous salt.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1904)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

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Bennett, A. Notes on *Potamogeton*. Jour. Bot. **42**: 69–77. 1 Mr 1904.

Several references to American species.

Bennett, M. E. Are roots aerotropic? Bot. Gaz. **37**: 241–259. *f. 1–5*. 16 Ap 1904.

Britten, J. Banks's Newfoundland plants. Jour. Bot. **42**: 84–86. 1 Mr 1904.

Britten, J. *Vaccinium vacillans*. Jour. Bot. **42**: 55. 1 F 1904.

Cardot, J. Notes on some North American mosses. Bryologist, **7**: 30, 31. 5 Mr 1904.

Claassen, E. On the occurrence of *Fossombronia cristula* in Ohio. Ohio Nat. **4**: 58. 20 Ja 1904.

Cockerell, T. D. A. Mutations and forms. Torreya, **4**: 58, 59. 28 Ap 1904.

Collins, J. F. Some erroneous references. Bryologist, **7**: 32, 33. 5 Mr 1904.

Cook, M. T. Galls and insects producing them. Ohio Nat. **4**: 115–139. *pl. 9–12*. 5 Ap 1904;—Appendix I. Ohio Nat. **4**: 140–147. *pl. 13–15*. 5 Ap 1904.

Coulter, S. M. An ecological comparison of some typical swamp areas. Ann. Rep. Missouri Bot. Gard. **15**: 39–71. *map. pl. 1–24*. 30 Ap 1904.

Coville, F. V. *Arcterica*, the rarest genus of heathers. Bot. Gaz. **37**: 298–302. *f. 1, 2.* 16 Ap 1904.

Coville, F. V. Wokas, a primitive food of the Klamath Indians. Rep. U. S. Nat. Mus. **1902**: 725–739. *pl. 1–13.* 1904.
Seeds of *Nymphaea polysepala.*

Evans, A. W. *Hepaticae* of Puerto Rico—IV. *Odontolejeunea, Cyclolejeunea* and *Prionolejeunea.* Bull. Torrey Club, **31**: 183–226. *pl. 8–12.* 28 Ap 1904.
With descriptions of *Cyc'olejeunea* gen. nov. and of 5 new species of *Prionolejeunea.*

Fink, B. Further notes on Cladonias. *Cladonia fimbriata.* Bryologist, **7**: 21–27. *pl. 3 + f. 7.* 5 Mr 1904.

Greene, E. L. Some Canadian Antennarias. — I. Ottawa Nat. **17**: 201–203. 4 Mr 1904.
Includes descriptions of 4 new species.

Grout, A. J. A new *Brachythecium.* Bryologist, **7**: 34. 5 Mr 1904.
B. rivulare tenue var. nov.

Hemsley, W. B. *Crossosoma californicum.* Curt. Bot. Mag. III. **60**: *pl. 7949.* Ap 1904.
Native of California.

Hemsley, W. B. *Passiflora vitifolia.* Curt. Bot. Mag. III. **60**: *pl. 7936.* 1 Ja 1904.
Native of tropical America.

Hemsley, W. B. *Solanum grandiflorum.* Curt. Bot. Mag. III. **60**: *pl. 7945.* 1 Mr 1904.
Native of South America.

Holzinger, J. M. The genus *Anacolia* in North America. Bryologist, **7**: 28, 29. 5 Mr 1904.

Hooker, J. D. *Lysichitum camtschatcense.* Curt. Bot. Mag. III. **60**: *pl. 7937.* 1 F 1904.

Jennings, O. E. Notes on some rare or interesting Ohio plants. Ohio Nat. **4**: 61. 20 Ja 1904.

Kellerman, W. A. & Jennings, O. E. Report for 1902 on the State Herbarium, including additions to the State Plant List. Ohio Nat. **4**: 69–73. 20 Ja 1904.

Lawson, A. A. The gametophytes, archegonia, fertilization and embryo of *Sequoia sempervirens.* Ann. Bot. **18**: 1–28. *pl. 1–4.* Ja 1904.

Lewton-Brain, L. Fungoid pests [attacking cotton in the West Indies]. West Indian Bull. **4**: 344–348. 1904.

Lyon, F. The evolution of the sex organs of plants. Bot. Gaz. **37**: 280–293. *f. 1–16.* 16 Ap 1904.

Mackenzie, K. K. Notes on evening primroses. Torreya, **4**: 56, 57. 28 Ap 1904.

With a description of *Oenothera argillicola* sp. nov., from West Virginia.

Moore, S. LeM. Mons. A. Robert's Matto Grosso plants.—I. Jour. Bot. **42**: 33–39. *pl. 456.* 1 F 1904;—II. Jour. Bot. **42**: 100–110. 1 Ap 1904.

Includes descriptions of 17 new species in 16 genera, two of which are new genera of *Acanthaceae: Tremacanthus* and *Salpingacanthus.*

Morgan, T. H. Polarity and regeneration in plants. Bull. Torrey Club, **31**: 227–230. 28 Ap 1904. [Illustr.]

Mottier, D. M. The development of the spermatozoid in *Chara.* Ann. Bot. **18**: 245–554. *pl. 17.* Ap 1904.

Nelson, A. Contributions from the Rocky Mountain Herbarium. V. Bot. Gaz. **37**: 260–279. 16 Ap 1904.

Includes descriptions of 28 new species in 24 genera, and of *Tonestus*, a new genus of *Compositae.*

Parish, S. B. A preliminary synopsis of the Southern California *Cyperaceae.* Bull. So. Cal. Acad. Sci. **3**: 35–37. 17 Mr 1904; 49–56. *pl. 2–4.* 16 Ap 1904.

Includes description and illustration of *Cyperus Parishii* Britton, sp. nov.

Parkin, J. The extra-floral nectaries of *Hevea brasiliensis* Müll.-Arg. (the Para rubber tree), an example of bud-scales serving as nectaries. Ann. Bot. **18**: 217–226. *pl. 16.* Ap 1904.

Peck, C. H. New species of *Fungi.* Bull. Torrey Club, **31**: 177–182. 28 Ap 1904.

Eleven new species in 16 genera.

Reed, H. S. A study of the enzyme-secreting cells in the seedlings of *Zea Mays* and *Phoenix dactylifera.* Ann. Bot. **18**: 267–287. *pl. 20.* Ap 1904.

Robertson, C. The structure of the flowers and the mode of pollination of the primitive angiosperms. Bot. Gaz. **37**: 294–298. 16 Ap 1904.

Rusby, H. H. William Marriott Canby. Torreya, **4**: 52–56. 28 Ap 1904.

Schaffner, J. H. Ohio plants with extra-floral nectaries and other glands. Ohio Nat. **4**: 103–106. 10 Mr 1904.

Schaffner, J. H. Poisonous and other injurious plants of Ohio. Ohio Nat. **4**: 69–73. 20 Ja 1904.

Schaffner, J. H. Some morphological peculiarities of the *Nymphaeaceae* and *Helobiae.* Ohio Nat. **4**: 83–92. *pl. 5–7* + *f. 1, 2.* 15 F 1904.

Spaulding, P. Two fungi growing in holes made by wood-boring insects. Ann. Rep. Missouri Bot. Gard. **15**: 73–77. *pl. 25–27.* 30 Ap 1904.

Sumstine, D. R. A new *Hydnum.* Torreya, 4: 59. 28 Ap 1904.
H. Earleanum sp. nov., from Pennsylvania.

Towle, P. M. & Gilbert, A. E. The fruiting season of the hair-cap moss. Bryologist, **7**: 35, 36. 5 Mr 1904.

Trelease, W. Aberrant veil remnants in some edible agarics. Ann. Rep. Missouri Bot. Gard. **15**: 83–85. *pl. 30–39.* 30 Ap 1904.

Trelease, W. An ecologically aberrant *Begonia.* Ann. Rep. Missouri Bot. Gard **15**: 79–81. *pl. 28, 29.* 30 Ap 1904.
B. unifolia Rose, sp. nov.

Underwood, L. M. The early writers on ferns and their collections — II. J. E. Smith, 1759–1828; Swartz, 1760–1818; Willdenow, 1765–1812. Torreya, **4**: 49–52. 28 Ap 1904.

Wiegand, K. M. & Foxworthy, F. W. A key to the genera of woody plants in winter, including those with hardy representatives found growing wild or in cultivation within New York State. 1–27. Ithaca, N. Y., 1904.

Woodward, B. B. Bibliographical notes. XXXI. — A. St. Hilaire's "Plantes usuelles des Brasiliens." Jour. Bot. **42**: 86, 87. 1 Mr 1904.